U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-272 689

Oil Spill and Oil Pollution Reports

California Univ, Santa Barbara Marine Science Inst

Prepared for

Industrial Environmental Research Lab, Cincinnati, Ohio

Jun 77

PB 272 689

EPA-600/2-77-111
June 1977

Environmental Protection Technology Series

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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SPRINGFIELD, VA. 22161

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PB272689

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO.
EPA-600/2-77-111

2.

3. RECIPIENT'S ACCESSION NO.

4. TITLE AND SUBTITLE
OIL SPILL AND OIL POLLUTION REPORTS
February 1977 - April 1977

5. REPORT DATE
June 1977 issuing date

6. PERFORMING ORGANIZATION CODE

7. AUTHOR(S)
Penelope Melvin, Helmut Ehrenspeck, and Paul Nordin

8. PERFORMING ORGANIZATION REPORT NO.

9. PERFORMING ORGANIZATION NAME AND ADDRESS
Marine Science Institute
University of California
Santa Barbara, California 93106

10. PROGRAM ELEMENT NO.
1BB041

11. CONTRACT/GRANT NO.
R-805052

12. SPONSORING AGENCY NAME AND ADDRESS
Industrial Environmental Research Laboratory-Cin.,OH
Office of Research and Development
U.S. Environmental Protection Agency
Cincinnati, Ohio 45268

13. TYPE OF REPORT AND PERIOD COVERED
Quarterly, Feb.-April, 1977

14. SPONSORING AGENCY CODE
EPA/600/12

15. SUPPLEMENTARY NOTES

16. ABSTRACT

The February 1977 - April 1977 issue of Oil Spill and Oil Pollution Reports is a quarterly compilation of oil pollution publications and ongoing project summaries. Presented in the report are: (a) summaries and citations of published literature and patents; (b) summaries and status of current research projects; and (c) current oil-related conferences. This report is submitted in partial fulfillment of EPA Grant No. R-805052 by the Marine Science Institute, University of California, Santa Barbara, under the sponsorship of the Environmental Protection Agency.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
*Bibliographies *Summaries *Patents *Documents *Research	Oil pollution Oil spill events Oil spill research Oil pollution control Oil pollution patents	13B

18. DISTRIBUTION STATEMENT RELEASE TO PUBLIC	19. SECURITY CLASS (This Report) UNCLASSIFIED	21. NO. OF PAGES 340
	20. SECURITY CLASS (This page) UNCLASSIFIED	22. PRICE A15-A01

EPA Form 2220-1 (9-73)

EPA-600/2-77-111
June 1977

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February 1977 - April 1977

by

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FOREWORD

When energy and material resources are extracted, processed, converted, and used, the related pollutional impacts on our environment and even on our health often require that new and increasingly more efficient pollution control methods be used. The Industrial Environmental Research Laboratory - Cincinnati (IERL-Ci) assists in developing and demonstrating new and improved methodologies that will meet these needs both efficiently and economically.

This report is a product of the above efforts. It cites current events, literature, research, patents, and other material relevant to the oil pollution abatement program and is published in an abstract format on a quarterly basis. As such, it serves as a basic reference document for all those interested in oil spill and oil pollution control. This project is part of the continuing program of the Oil and Hazardous Materials Spills Branch, IERL-Ci to assess and mitigate the environmental impact of oil pollution.

David G. Stephan
Director
Industrial Environmental Research Laboratory
Cincinnati

ABSTRACT

OIL SPILL AND OIL POLLUTION REPORTS is a quarterly bulletin designed to review current scientific and technical publications and research projects in the field of oil pollution. Subject coverage includes all aspects of aquatic and terrestrial oil pollution. This issue contains summaries of research projects and published information selected from the scientific and technical literature during the period February, 1977 through April, 1977.

The following sections are included in the report:

I. Reports, Publications, and Patents
II. Current Research Projects
III. Current Oil-Related Conferences

This report is submitted in partial fulfillment of EPA Grant No. R805052-01 by the Marine Science Institute, University of California, Santa Barbara, California, under the sponsorship of the Environmental Protection Agency.

CONTENTS

Page

Abstract iv

Acknowledgments viii

Introduction ix

Abbreviations - Acronyms x

Sections

I. Reports, Publications, and Patents

A. Oil Pollution Detection and Evaluation

1. Reporting 1

Oil Discharges in U.S. Waters - 1975 12

2. Monitoring 18

3. Remote Sensing. 29

4. Sampling. 33

5. Analysis. 36

6. Source Identification 49

B. Oil Pollution Prevention and Control

1. Containment 51

2. Cleanup and Recovery. 54

3. Restoration 73

4. Oil Transfer and Transport. 75

5. Waste Treatment and Disposal Methods. 82

6. Reclamation and Reuse 100

7. Personnel Training and Education. 102

8. Contingency Planning 104
9. Prevention and Control Measures 108

C. Effects of Oil Pollution **Page**

1. Biological Effects 110
2. Economic Effects 144
3. General Effects 145

D. Effects of Oil Exploration and Production

1. Biological Effects 150
2. Physical Effects 152
3. Social Effects 153
4. Economic Effects 154
5. General Effects. 155

E. Fate of Oil in the Environment

1. Biodegradation 179
2. Physical Changes 196
3. Chemical Changes 200
4. General Fate of Oil. 201

F. Oil Pollution Regulations

1. U.S. Legislation 213
2. Standards and Guidelines 216
3. Agreements and Conventions 218
G. Bibliographies 219

II. Current Research Projects

A. Oil Pollution Detection and Evaluation

1. Monitoring 221
2. Remote Sensing 223

3. Analysis 225

B. Oil Pollution Prevention and Control Page

1. Containment 226
2. Cleanup and Recovery. 226
3. Oil Transfer and Transport. 227
4. Waste Treatment and Disposal Methods. 228

C. Effects of Oil Pollution

1. Biological Effects. 230
2. Chemical Effects. 235
3. General Effects 236

D. Effects of Oil Exploration and Production

1. General Effects 239

E. Fate of Oil in the Marine Environment

1. Biodegradation 241
2. General Fate of Oil 245
III. Current Conferences 248
Master List of Keywords 256
Subject Index 261
Author Index . . . .
Appendix. . . . .

ACKNOWLEDGEMENTS

The authors appreciate the assistance of Ms. Kathy Courtney and Ms. Patti Thurston in typing the camera-ready copy of Oil Spill and Oil Pollution Reports. We also wish to thank the personnel of the Science-Engineering Library, University of California, Santa Barbara, for their assistance during the research stages of the project.

INTRODUCTION

OIL SPILL AND OIL POLLUTION REPORTS is a quarterly bulletin which reviews pertinent scientific and technical publications and research projects to provide its readers with current developments in the field of oil pollution. This issue contains summaries of articles, reports, patents, documents, and other materials relating to oil pollution published during the period 1974 to 1977 (Section I), summaries and status of current research projects (Section II), and current oil-related conferences (Section III).

Subjects covered include all aspects of aquatic and terrestrial oil pollution. Items in Section I are categorized by seven major subdivisions which are divided into thirty-one specific subject categories. These are presented in the Table of Contents. Patents and patent applications are announced under appropriate subject categories. Subject and author indexes for entries in Section I are provided at the end of the report. A list of the periodicals reviewed in preparing this series appears in the Appendix.

Section II presents titles of active or recently completed oil pollution research projects, summaries of project objectives, and current status information and/or resulting publications provided upon request by the principal investigators or performing organization. Notices of research projects were obtained from the Smithsonian Science Information Exchange (SSIE); American Society for Microbiology, Aquatic Microbiology Newsletter; and Canada, Department of the Environment, Spill Technology Newsletter. Entries are arranged according to the same subject categories as in Section I and are ordered by serial number within each subject division. Some of the current projects listed in previous Oil Pollution Reports have been recently renewed. These projects have been relisted and headed by the same serial number as originally reported, followed by the word (renewal). Renewal entries are listed at the beginning of each subject category.

Section III, Current Oil-Related Conferences, contains descriptive information on recently held and upcoming conferences relevant to any aspects of oil pollution. Conference dates are listed; and, when information is available, titles, authors, and abstracts of conference papers are included. All information for this section was obtained from the periodicals reviewed (Appendix) and from responses to written inquiries concerning the meetings.

Entries in Section I and II have separate serial numbers. The letters preceding the serial numbers designate the following: C, reports, publications, and patents; and R, research projects.

ABBREVIATIONS

atm	atmosphere
bbl	barrel
°C	degrees Centigrade
cm	centimeter
dwt	dead weight ton
°F	degrees Fahrenheit
ft	foot
g	gram
gal	gallon
GLC	gas-liquid chromatography
gpd	gallons per day
gph	gallons per hour
gpm	gallons per minute
ha	hectare
hr	hour
i.e.	(id est), that is
in	inch
IR	infrared
kg	kilogram
km	kilometers
kn	knot
l	liter
lb	pound
LNG	liquefied natural gas
LOT	load on top
LPG	liquefied petroleum gas
m	meter
mg	milligram
mi	mile
min	minute
ml	milliliter
mm	millimeter
OCS	outer continental shelf
oz	ounce
PAH	polycyclic aromatic hydrocarbon
pH	the negative log of the H ion concentration
ppb	part per billion
ppm	part per million
sp.	species
TLC	thin-layer chromatography
U.S.	United States
USSR	Union of Soviet Socialist Republics
UV	ultraviolet
VLCC	very large crude carrier
wt	weight
yr	year
μ	micron
%	percent
/	per

ACRONYMS

API	American Petroleum Institute
BLM	Bureau of Land Management
CEQ	Council on Environmental Quality
EPA	Environmental Protection Agency
ERDA	Energy Research and Development Administration
FEA	Federal Energy Administration
IMCO	International Maritime Consultative Organization
NASA	National Aeronautics and Space Administration
NBS	National Bureau of Standards
NOAA	National Oceanic and Atmospheric Administration
NTIS	National Technical Information Service
UN	United Nations
USCG	United States Coast Guard (DOT)
USGS	United States Geological Survey
USDI	United States Department of Interior
USDA	United States Department of Agriculture
USN	United States Navy

SECTION I. REPORTS, PUBLICATIONS, AND PATENTS

A. OIL POLLUTION DETECTION AND EVALUATION

1. REPORTING

C-0449-77
COUNTING THE BIRDS (news brief)
Anon, 1976.
Marine Pollution Bulletin 7(12):221.

Contamination, Birds, Coasts, UK, *Mortality

The Beached Bird Survey in the United Kingdom is described in which volunteers walk coastlines five times during each winter to check for stricken birds. From their records of birds found, species, sex, and extent of oil pollution, the Royal Society of the Protection of Birds has been able to develop a picture of the oil pollution problem as it affects birds in the UK, and its variations both regional and seasonal.

C-0450-77
AN EPIDEMIC OF OIL SPILLS(news brief)
Anon. 1977.
Environmental Action (8)17:15.

Oil spills, Tankers, Regulations, Tar, Argo Merchant spill, *Liberian tankers

Eight Liberian tankers were involved in oil spill incidents over a three week period; the largest spill war caused by the grounding and breaking up of the "Argo Merchant". Liberian tanker regulations are discussed and API's investigation intr tar balls is reported.

C-0451-77
EXPLOSION RISK ON SUPERTANKERS (news brief)
Anon. 1976.
Marine Pollution Bulletin 7(12):219.

Tankers, Oil tanks, Cleanup, *Explosions, *Safety systems

A report at a London shipping seminar stated that hundreds of oil-carrying supertankers could explode during tank cleaning at sea if a malfunction occurs in a built-in safety system specifically designed to reduce the risk of a vessel blowing up during the operation. The explosion of the Norwegian tanker, "Berge Istra", is briefly discussed as an example of a disaster caused by such a malfunction.

C-0452-77
L.A. TANKER BLAST BAD NEWS FOR OIL (news brief)
Anon. 1976.
Oil and Gas Journal 74(52):90.

Tankers, Oil industry, Development, Southern California, *Sansinena explosion

The oil tanker "Sansinena" explosion is discussed and the possible effects of this event on oil development and the oil industry in Southern California are presented. Alaskan oil and liquefied natural gas are mentioned specifically.

C-0453-77
NATO AND OIL (news brief)
Anon. 1976.
Marine Pollution Bulletin 7(12):220.

Offshore development, North Sea, Oil spills, Leakage, Contingency planning, *NATO

The director-general of the Norwegian Ministry of the Environment stated at a NATO meeting that the danger of a serious leak from North Sea oil fields was becoming more acute as offshore oil activities increased in the North Sea. He recommended that NATO countries concerned should prepare for such a disaster by organizing joint exercises on emergency procedures.

C-0454-77
NORTH SEA OIL SPILL AVERTED (news brief)
Anon. 1977.
Marine Pollution Bulletin 8(1):4.

Oil spills, Offshore production, Platforms, North Sea, *Oxygen corrosion

The shutdown of a British Petroleum offshore platform to stop the spillage of oil from a pipe fracture is described; the effects of oxygen corrosion on steel pipes are discussed.

C-0455-77
OIL SPILLS IN GULF OF MEXICO DOCUMENTED (news brief)
Anon. 1976.
Sea Technology 17(12):31.

Oil spills, Environmental effects, Gulf of Mexico, OCS, *USGS report

A 47 page report, "Oil Spills, 1971-1975, Gulf of Mexico Outer Continental Shelf", published as U.S.G.S. Circular 741, is available free from the U.S. Geological Survey's Branch of Distribution, 1200 South Eads St., Arlington, VA 2220C. Accounts of oil spills, their causes and environmental effects are reported.

C-0456-77
OIL TROUBLES WATERS (news brief)
Anon. 1977.
Chemical Week 120(1):15.

Oil spills, Tankers, Cleanup, Argo Merchant spill, *Olympic Games spill, *Sansinena spill

The recent oil tanker disasters of the "Argo Merchant", "Olympic Games", and "Sansinena" are briefly reviewed and cleanup measures are discussed.

C-0457-77
POURING TROUBLED OIL ON ATLANTIC WATERS (news brief)
Anon. 1977.
Science News 111(1):6.

Oil spills, Atlantic coast, Tankers, Environmental effects, Argo Merchant spill

The grounding of the oil tanker, "Argo Merchant", is reviewed and the possible environmental effects of the spilled oil are discussed.

C-0458-77
RESOURCE DEVELOPMENT - PROCESSES AND PROBLEMS: THE 27TH ALASKA SCIENCE CONFERENCE, SPONSORED BY THE ALASKA DIVISION OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE AND HELD AT THE UNIVERSITY OF ALASKA, FAIRBANKS, ALASKA, 4-6 AUGUST 1976.
Anon. 1976.
Environmental Conservation 3(4):310.

Pipelines, Offshore development, OCS, Environmental effects, Economics, Alaska, *Trans-Alaska pipeline

Over 125 papers and several panel discussions were presented at this conference on the current status of resource development in the North, with special reference to Alaska. Topics discussed included environmental impacts of the trans-Alaska pipeline, environmental problems associated with the exploration of the proposed outer continental shelf oil reserves, and biological, social, and economic concerns related to current development in the North.

C-0459-77
A TANKER GOES AGROUND
Anon. 1976.
Safety at Sea International 86:16-17.

Oil spills, Tankers, Environmental effects, Cleanup, Alaska, *Cold Bay

An account is given of the grounding of the tanker, "Hillyer Brown", and the subsequent oil spill. The environmental effects of the spill on the Cold Bay, Alaska ecosystem are discussed and the U.S. Coast Guard's attempt to clean up the spilled oil is described.

C-0460-77
URQUIOLA SPILL (news brief)
Anon. 1977.
Marine Pollution Bulletin 8(1):3.

Oil spills, Contamination, Coasts, Spain, *Shellfish, *Urquiola spill

The damage to the Spanish shellfish industry due to the oil contamination of 320 km (200 mi)of coastline is discussed and the cause of the Urquiola disaster is reviewed.

C-0461-77
THE CRUDE OIL POLLUTION OF SAND BEACH BY THE ACCIDENT OF A TANKER "THE JULIANA" OFF NIIGATA COAST IN 1971
Aoki, S., K. Chihara, I. Kobayashi, and K. Taguchi. 1976.
Science Report of Niigata University Series E, No. 3. p. 51-62.

Oil spills, Crude oil, Tankers, Spreading, Movement, Cleanup, Dispersants, Beaches, Japan

The grounding of a tanker near the port of Niigata, Japan, in late November 1971, and the resultant crude oil spill are chronologically reviewed. The spreading and movement of the spill onto beaches and efforts to chemically disperse the spilled oil on water and land are described in detail.

C-0462-77
ESTIMATING THE POTENTIAL FOR FUTURE OIL SPILLS FROM TANKERS, OFFSHORE DEVELOPMENT, AND ONSHORE PIPELINES
Beyer, A. H., and L. J. Painter. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 21-30. (American Petroleum Institute No. 4284.)

Oil spills, Statistics, Tankers, Offshore development, Pipelines, *Spill predictions

Historical spill statistics are summarized and techniques and equations are described to predict possible future oil spillage from marine tankers, offshore petroleum development facilities, and cross-country pipelines. Information compiled indicates that word-wide tanker spills can be expected to occur within 80 km (50 miles) of land an average of one in every 1,000 vessel port-calls, with an average size of 7,100 bbl and average spill rate of about 87 bpmb (bbl per million bbl). Average spill rates from offshore oil facilities and cross-country pipelines are estimated to be about 72 bpmb and 3.6 bpmb, respectively.

C-0463-77
OIL AND GAS SEEPS IN ALASKA. NORTH-CENTRAL GULF OF ALASKA
Blasko, D. P. 1976.
U.S. Bureau of Mines, Report of Investigation, RI8136. 123p.

Natural seepage, Hydrocarbons, Chemical analysis, Gulf of Alaska

Results presented of a study of oil and gas seeps in the Katalla River - Bering River and Cape Yakataga - Yakutat Bay regions of Alaska. The activity and characteristics of previously reported hydrocarbon seeps were investigated, and the bitumen content of drainages associated with seeps was determined.

[from Chemical Abstracts 86(4):#19197s. 1977]

C-0464-77
THE STATISTICAL PICTURE REGARDING DISCHARGES OF PETROLEUM HYDROCARBONS IN AND AROUND UNITED STATES WATERS
Boyd, B. D., C. C. Bates, and J. R. Harrald. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 38-53. Proceedings of the Symposium, American University, Washington, D.C., 9-11 August 1976.

Statistics, Oil discharges, U.S., Information systems

Statistics regarding the discharge of petroleum hydrocarbons in and around U.S. waters in 1974 are tabulated and discussed. The information is taken from the 1975 National Academy of Sciences study "Petroleum in the Marine Environment", and data from the USCG Pollution Incident Reporting System (PIRS). The nature and objectives of these two data bases are briefly compared.

C-0465-77
OIL AND SALT WATER SPILLS IN THE PROVINCE OF ALBERTA
Brushett, E. R. 1975.
Conference on the Environmental Effects of Oil and Salt Water Spills on Land, Banff, Alberta, 1975. Alberta Environment, and University of Calgary, 1975. p. 12-20.

Oil spills, *Salt water spills, Statistics, Pipelines, Canada, *Alberta

With an annual output of over 500 million barrels of oil per year and nearly [illegible] million barrels of salt water accompanying the oil, some salt water and oil spills in Alberta are certain to occur. Spill statistics for Alberta are reviewed and analyzed for the years 1972 to 1975. It is concluded that pipeline breakage and corrosion represent the greatest inland source of salt water and oil spills.

C-0466-77
ENVIRONMENTAL EFFECTS OF SCHUYLKILL OIL SPILL II, JUNE 1972
Environmental Protection Agency. 1975.
EPA/430/9-75/019. 205p.

Oil spills, Waste oil, Rivers, Environmental effects, Vegetation, Pennsylvania, *Schuylkill spill

About 23 to 30 million liters (six to eight million gal) of waste crankcase oil rerefined sludge were spilled into the Schuylkill River, Pennsylvania, during a flood. No direct permanent effects were noted; however, higher concentrations of lead and zinc were observed downstream. Concentrations of lead and petroleum hydrocarbons in sediments were higher at downstream stations. Concentrations of lead in downstream benthic macrofauna were also higher.

[from Government Reports Announcements 76(25):#PB-250 412/6GA. 1976]

C-0467-77
OIL SPILLS AND SPILLS OF HAZARDOUS SUBSTANCES
Environmental Protection Agency, Oil and Special Materials Control Division. 1977.
Environmental Protection Agency. 40p.

Oil spills, Biological effects, Pollution prevention, Cleanup, Surveillance, International agreements

This document describes some of the more significant spill incidents and the mechanisms, both managerial and technological, to deal with them. Included in the contents are: effects of spills; prevention of spills; responding to spills; spill surveillance, spill incidents; spills of hazardous substances; international cooperation; and EPA regional offices.

C-0468-77
AN ESTIMATE OF THE AMOUNT OF OIL ENTERING THE OCEANS
Grossling, B. F. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 6-37.
Proceedings of the Symposium, American University, Washington, D.C., 9-11 August 1976.

Statistical analysis, *Oil input, Sources, Oceans, Crude oil, Waste oil, Oil discharges, Tankers, Natural seepage

The annual world ocean inputs of crude oil and petroleum products from natural and manmade sources were estimated for the year 1972. Spent lubricants contributed about 2.6 million m tons (17.1 million bbl); oil industry accidents, about 980,000 m tons (6.4 million bbl); tanker cleaning discharges, about 360,000 m tons (2.6 million bbl); and offshore and onshore natural seeps together contributed roughly 1-30 million m tons (7.5-220 million bbl). Total world crude oil production was assessed to be about 8 billion m tons (27.5 billion bbl).

C-0469-77
INPUT OF HYDROCARBONS FROM SEEPS AND RECENT BIOGENIC SOURCES
Koons, C. B., and P. H. Monaghan. 1976.
Sources, Effects, & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 84-107.
Proceedings of the Symposium, American University, Washington, D.C., 9-11 August 1976.

Sources, Hydrocarbons, Oceans, Natural seepage, *Biogenic hydrocarbons, *Input estimates

The amounts of hydrocarbons in the world's oceans contributed by various natural sources and processes are estimated. Input from submarine seepage is estimated to be 0.6 million m tons/year, and input from biochemical processes in the oceans, 6 million m tons/year. The amounts of hydrocarbons transported to the oceans from natural sources on land are as yet unknown. Biochemical synthesis of hydrocarbons is briefly described, and contrasting characteristics of seepage and biogenic hydrocarbons are reviewed.

C-0470-77
OIL SPILL CONTAINMENT AND REMOVAL IN ARCTIC ECOSYSTEMS
McLeod, W. R., and D. L. McLeod. 1974.
Energy Resources and Management. Rolla, Missouri, Missouri University, 1974. p. 135-144.

Oil spills, Cleanup, Recovery, Disposal, Ecosystems, Arctic

Sixteen arctic and sub-arctic oil spills, their locations, amount of oil spilled, combatant schemes used in cleanup operations, and causes for the spills are reported. Analysis of the effectiveness of available chemical, mechanical, and destructive means of oil recovery or disposal under arctic and sub-arctic conditions is discussed and recommendations for further research on these problems are given.

[from Petroleum Abstracts 16(44):#226, 378. 1976]

C-0471-77
TO DRILL OR NOT TO DRILL
Mitchell, J. G. 1977.
Audubon 79(1):78-85.

Oil industry, Exploration, Drilling, *Michigan, *Baker Sanctuary

The history of the acquisition of Baker Sanctuary in Michigan is reviewed and the debate over oil exploration and development at the sanctuary is discussed.

C-0472-77
SOURCES AND DISTRIBUTION OF HYDROCARBONS IN THE ENVIRONMENT
Myers, L. H. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 66-83. Proceedings of the Symposium, American University, Washington, D.C., 9-11 August 1976.

Hydrocarbons, Sources, Distribution, Industries, Refineries, *Municipal discharges, *Runoff

The various sources and distributions of biogenic and petroleum hydrocarbons are reviewed and tabulated. Industrial sources of hydrocarbon wastes are petroleum production and refining, the petrochemical industry, steel and iron manufacture, food and kindred products, and textile mills. Agriculture and municipal discharges and runoff are other major sources for petroleum-related hydrocarbons.

C-0473-77
KACHEMAK BAY: OIL SPILLS LEAD ALASKA TO REVERSE DRILLING OK
Panitch, M. 1976.
Science 193(4248):131.

Oil spills, Offshore drilling, Environmental effects, Alaska, *Kachemak Bay

The history of the George Ferris oil spill in Kachemak Bay, lower Cook Inlet, Alaska is reviewed. The political, economic, and environmental effects of the spill are discussed and Alaskan plans to buy back the lease that was sold three years ago to oil interests are described.

C-0474-77
JUST ANOTHER OIL SPILL
Reiger, G. 1977.
Audubon 79(1):144-148.

Oil spills, Cleanup, Pollution prevention, Birds, Wildlife, Chesapeake Bay, USCG

An account of an oil spill involving the tug, "Falcon", in Chesapeake Bay in 1976 is given. The actions of the U.S. Coast Guard in preventing and cleaning up the spilled oil are described and the deaths of birds and wildlife are discussed.

C-0475-77
THE CHESAPEAKE BAY OIL SPILL - FEBRUARY 2, 1976: A CASE HISTORY
Roland, J. V., G. E. Moore, and M. A. Bellanca. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 523-527. (American Petroleum Institute No. 4284).

Oil spills, Environmental effects, Beaches, Marshes, Marine organisms, Chesapeake Bay

A case history analysis is presented of the Chesapeake Bay oil spill in which about 946,000 liters (250,000 gallons) of No. 6 oil were discharged into the bay after a barge, the STC-101, sank in a storm near the Potomac River. The oil contaminated extensive beach and marsh areas on both sides of the bay. Approximately 632,000 liters (167,000 gallons) of oil were recovered by cleanup crews. An overall assessment of the environmental damages caused by the spill is almost complete.

C-0476-77
A PERSPECTIVE ON THE REGIONAL WATER QUALITY IMPACTS OF PETROLEUM FACILITIES
Schimke, G. R., C. B. Cooper, and E. H. Dohnert. 1975.
American Institute of Chemical Engineers Symposium Series 7(151): 26-33.

Oil spills, Ports, Pipelines, Refineries, Oil discharges, Water quality, *Petroleum facilities

Discussed are spills associated with ocean terminals and pipelines, and major water quality problems of petroleum refineries. Volumetrically, the oceanic oil pollution contributed by terminals and refineries is relatively small. Refinery discharges into small streams cause significant adverse water quality impacts regardless of the treatment technology.

[from Chemical Abstracts 76(4):#21458j. 1977]

C-0477-77
POLLUTER DISCRIMINANT ANALYSIS
Tock, D. G. 1976.
Water Resources Research 12(4):613-616.

Oil spills, U.S., Statistical analysis, Models, Great Lakes, Coasts, *Discriminant analysis

Statistics in a water pollution data base for U.S. coastal waterways and Great Lakes are used to develop a model, using multiple discriminant techniques, to determine which pollution incident report variables will discriminate the polluter who reports a spill from one who does not report a spill. As few as 9 variables out of a possible 60 provide sufficient discriminatory power .

[from Pollution Abstracts 8(1):#77-00312. 1977]

C-0478-77
A REVIEW OF WORLD OIL SPILLAGES, 1960-1975
van-Gelder-Ottway, S., and M. Knight. 1975.
International Petroleum/Field Studies Council Meeting on Marine Ecology and Oil Pollution, Scotland, 1975. p. 483-520.

Oil spills, Biological effects, Monitoring

Basic details of major oil spillages in recent years are listed and subsequent biological effects that have been monitored are included. The emphasis on reporting oil pollution incidents since 1967 is more a product of the increasing awareness of potential biological damage from these spills than of increases in the number of incidents.

[from Energy Information Abstracts 1(5):#76-23740. 1976]

C-0479-77
PROJECTION OF PETROLEUM CONTENT OF URBAN RUNOFF
Whipple, W., Jr., J. V. Hunter, and S. L. Yu. 1976.
Petroleum Industry in the Delaware Estuary. Staff report,
NSF-RANN Project G42282.

Industries, Refineries, Delaware, *Urban runoff, *Oil content, *Delaware Estuary

Summary not available.

[from Urbanization and Water Quality Control. W. Whipple, Jr. (ed.) Minneapolis, Minnesota, American Water Resources Association, 1976. p. 168]

C-0480-77
THE ARGO MERCHANT AND BEYOND
Worthington, V. 1977.
Conservation News 42(3):8-10.

Oil spills, Environmental effects, Tankers, Cleanup, Argo Merchant spill

The environmental consequences of the Argo Merchant oil spill are reviewed and possible legislation concerning oil disasters and tankers is presented. Other recent Liberian tanker disasters are described and the U.S. Coast Guard's efforts to contain and cleanup the spilled oil are discussed.

C-0481-77

The following tables include data relating to oil discharges in the United States and contiguous waters during the calendar year 1976. The information was obtained from the U.S. Coast Guard publication, "Pollution Incidents in and Around U.S. Waters," and is based on incidents reported to or discovered by Coast Guard personnel.

GENERAL AREAS

	Number of Incidents	% of Total	Volume in gallons	% of Total
Atlantic Coast	2,695	26.6	1,465,689	10.2
Gulf Coast (West of Long. 83°15')	3,315	32.8	5,430,212	37.6
Pacific Coast	1,768	17.4	440,923	3.0
Great Lakes	454	4.4	307,772	2.1
Inland U.S.	1,909	18.8	6,795,001	47.1
TOTAL	10,141	100.0	14,439,597	100.0

TYPE OF LOCATION

	Number of Incidents	% of Total	Volume in gallons	% of Total
Inland Waters				
1. Roadsteads	120	1.0	37,164	.3
2. Ports	472	4.8	1,106,611	7.7
3. Beaches	96	.9	88,537	.6
4. River areas	836	8.2	3,816,371	26.4
5. Non-navigable areas	112	1.1	303,752	2.1
TOTAL	1,636	16.0	5,352,435	37.1
Coastal Waters (including Great Lakes)				
1. Bays, estuaries and sounds	1,117	11.0	3,227,563	22.3
2. Ports	3,937	38.9	2,173,847	15.1
3. Beaches	159	1.6	108,588	.8
4. River areas	1,272	12.5	2,008,819	13.9
5. Non-navigable areas	192	1.9	214,447	1.5
6. Open waters (Great Lakes or territorial sea)	955	9.4	453,683	3.1
TOTAL	7,632	75.3	8,186,947	56.7
Contiguous zone	188	1.9	5,725	.0
High seas	692	6.8	894,490	6.2
TOTAL	10,141	100.0	14,439,597	100.0

TYPE OF MATERIAL DISCHARGE

	Number of incidents	% of Total	Volume of gallons	% of Total
Crude oil	2,678	26.4	7,664,034	53.0
Gasoline	540	5.3	1,393,367	9.6
Other distillate fuel oil	273	2.7	952,725	6.7
Solvent	50	0.5	8,683	0.0
Diesel oil	1,736	17.1	843,406	5.9
Asphalt or residual fuel oil	1,010	10.0	739,066	5.1
Animal or vegetable oil	72	0.7	54,162	0.4
Waste oil	1,094	10.8	197,706	1.4
Other oil	2,688	26.5	2,586,648	17.9
TOTAL	10,141	100.0	14,439,597	100.0

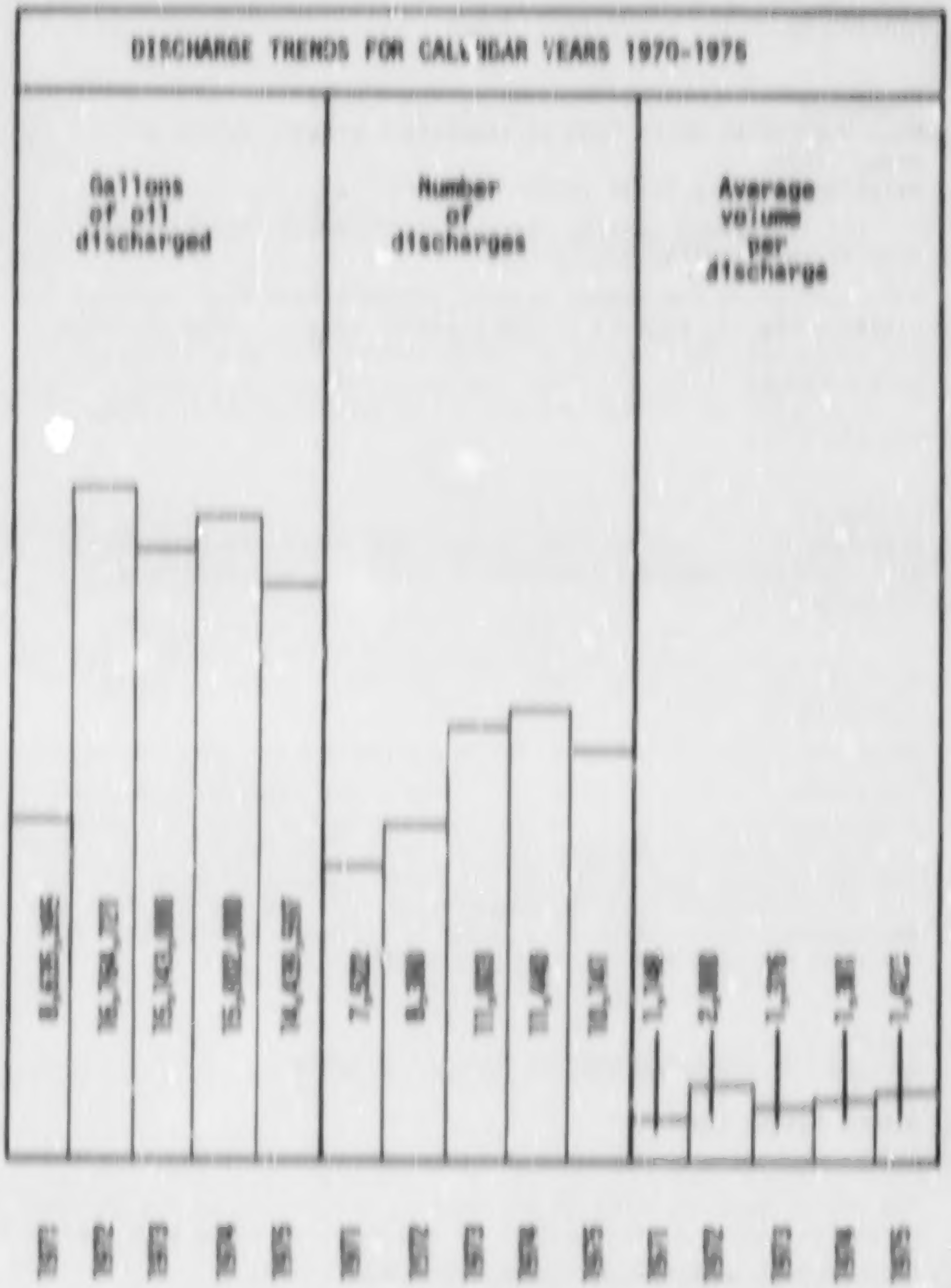
SOURCES

	Number of Incidents	% of Total	Volume in gallons	% of Total
VESSELS				
1. Dry cargo ships	277	2.7	21,843	0.2
2. Dry cargo barges	31	0.3	5,215	0.0
3. Tank ships	643	6.3	1,766,729	12.2
4. Tank barges	767	7.6	3,467,203	24.0
5. Combatant vessels	202	2.0	16,913	0.1
6. Other vessels	1,143	11.3	1,353,947	9.4
TOTAL	3,063	30.1	6,631,850	45.9
LAND VEHICLES				
1. Rail vehicles	37	0.4	576,507	4.0
2. Highway vehicles	263	2.6	356,601	2.4
3. Other/unknown vehicles	10	0.1	2,617	0.0
TOTAL	310	3.1	935,725	6.4
NON-TRANSPORTATION-RELATED FACILITIES				
1. Onshore refinery	176	1.7	146,722	1.0
2. Onshore bulk/storage	305	3.0	476,768	3.3
3. Onshore production	233	2.3	2,626,992	18.2
4. Offshore production facilities	1,243	12.3	78,217	0.5
5. Other facilities	762	7.5	567,924	4.0
TOTAL	2,719	26.8	3,896,623	27.0
PIPELINES	564	5.6	2,490,237	17.3
MARINE FACILITIES				
1. Onshore/offshore bulk cargo transfer	250	2.5	81,333	0.6
2. Onshore/offshore fueling	74	0.7	9,388	0.0
3. Onshore/offshore nonbulk cargo transfer	19	0.2	1,326	0.0
4. Other transportation-related marine facilities	80	0.8	7,239	0.0
TOTAL	423	4.2	99,156	0.6
LAND FACILITIES	157	1.6	200,962	1.5
MISC/UNKNOWN	2,905	28.6	186,044	1.3
TOTAL	10,141	100.00	14,439,597	100.00

CAUSES

	Number of Incidents	% of Total	Volume in gallons	% of Total
Hull/tank rupture/leak	757	7.5	6,359,433	44.0
Transportation pipeline rupture leak	235	2.3	1,200,004	8.3
Other structural failure	200	2.0	2,744,656	19.0
Pipe rupture/leak	954	9.5	1,322,385	9.2
Hose rupture/leak	220	2.1	120,203	0.8
Valve failure	256	2.5	251,608	1.7
Pump failure	110	1.0	39,499	0.3
Other rupture/leak	79	.2	94,683	0.7
Other equipment failure	1,069	10.5	221,956	1.5
Tank overflow	464	4.5	473,454	3.3
Improper handling operation	679	6.5	276,226	4.3
Othr personnel error	511	5.1	504,976	3.5
Bilge pumping	195	1.9	14,821	0.1
Ballast pumping	21	.2	764	0.0
Other intentional discharge	269	2.6	196,089	1.4
Natural or chronic phenomenon	352	3.5	144,115	1.0
Unknown/Miscellaneous	3,820	38.1	474,735	0.9
TOTAL	10,141	100.00	14,439,597	100.00

DISCHARGE TRENDS FOR CALENDAR YEARS 1970-1975



2. MONITORING

C-0482-77
NASA MONITORING HELPS NOAA IN TRACKING OIL SPILL IN ATLANTIC
Anon. 1977.
Aviation Weekly & Space Technology 106(2):21.

Oil spills, Remote sensing, Spreading, Movement, Atlantic Ocean, Argo Merchant spill, Monitoring

NASA spacecraft and remote sensing aircraft have been involved in tracking the oil spilled by the Liberian tanker, "Argo Merchant", off Nantucket, Massachusetts. NASA overflights were initiated in late December, 1976, and have continued into early January, 1977, in an attempt to monitor and track the spreading and movement of the oil slick.

C-0483-77
DEVELOPMENT AND TEST OF A SHIPBOARD, CONTINUOUS, ON-LINE OIL-IN-WATER CONTENT MONITOR USING FORWARD (LASER) LIGHT SCATTERING TECHNIQUES
Batutis, E. P., and R. L. Skewes. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 157-160. (American Petroleum Institute No. 4284)

Detection, Ships, Monitoring, Design and engineering, USCG, *Oil-in-wate

Procedures and results of a U.S. Coast Guard program to evaluate a shipboard oil-in-water content monitoring approach developed by General Electric Company are reviewed. The concept used allows for the detection of 0-100 ppm of a wide variety of oils and has low sensitivity to salinity, temperature, pH, and the presence of detergents. The instrument package is compact, lightweight, and designed for continuous monitoring capability.

C-0484-77
PROCESS FOR MEASURING THE OIL CONTENT OF WATER
Bolzmann, H. 1976.
German Patent 2,408,772

Oil slicks, Patent, Monitoring, *Oil content, *Echo sounding

The oil content of water is measured as a function of the thickness of the oil layer at the surface of the water by using echo sounding.

[from Petroleum Abstracts 16(42):#226,002. 1976]

C-0485-77
SHIPBOARD OIL-IN-WATER MONITOR
Bordeaux, J. 1976.
Final report, FR-2677-101; Contract N00024-74-C-5445. 57p.

Monitoring, Oilslicks, Ships, Solvents, Spectroscopy, Absorption, *Laser beam

An oil-in-water monitor is described which uses solvent extraction of oil and measures the infrared energy absorbed by the C-H bond. A cellulose acetate non-woven tape is saturated with perchlorethylene and the oily water is impinged onto the tape. The oil is extracted and the IR absorption measured using a dual beam laser system.

[from Government Reports Announcements 72(22):#AD-A028 785/4GA. 1976]

C-0486-77
MONITORING PROCEDURES FOR CHEMICAL CARCINOGENS IN COASTAL WATERS
Dunn, B. P., and H. F. Stich. 1976.
Journal of the Fisheries Research Board of Canada 33(9):2040-2046.

PAH, Coasts, Chemical analysis, Chromatography, Fluorimetry, Monitoring, Sampling, Carcinogens, *Coastal waters

Sampling and analytical procedures developed to assess the contamination of coastal waters by carcinogenic polycyclic aromatic hydrocarbons (PAH) are discussed. The procedures involved extraction and purification of hydrocarbon fractions from marine sediments and organisms, and detection of compounds by thin-layer chromatography, fluorimetry, or gas chromatography.

[from Chemical Abstracts 86(4):#21402z. 1977]

C-0487-77
BASELINE LEVELS OF BENZO(A)PYRENE IN SOUTHERN CALIFORNIA MUSSELS
Dunn, B. P., and D. R. Young. 1976.
Marine Pollution Bulletin 7(12):231-234.

PAH, Mollusks, Southern California, Carcinogens, Monitoring, *Mussels *Benzo(a)pyrene

A survey was made of the levels of benzo(a)pyrene in mussels from 19 mainland and 6 island stations in the California Bight. The study indicates that carcinogen levels in mussels are at or near zero, except in areas of human activity. These findings contradict previous suggestions that benzo(a)pyrene is widely distributed in marine organisms.

C-0488-77
LIGHT SCATTERING TECHNIQUES FOR DISCRIMINATING BETWEEN OIL AND PARTICULATES IN CONTAMINATED WATER
Friedman, D. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 153-156. (American Petroleum Institute No. 4284)

Detection, Wastewaters, Analytical techniques, Monitoring, *Particulates, *Oil-in-water, *Light scattering

Particulate matter interferes with the application of light scattering techniques used in several existing and proposed types of oil-in-water monitors. A mathematical analysis was made of the possibility of discriminating between oil and particulates by using measurements of the angular intensity distribution of scattered light. It was found that, even with the determination of the state of polarization of the scattered light, a distinction of oil and particulates is difficult.

C-0489-77
EXPERIENCE IN MONITORING THE OIL CONTENT OF BALLAST WATER BEING DISCHARGED BY TANKERS
Fleming, K., and J. P. P. Dick. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 165-168. (American Petroleum Institute No. 4284)

Oil discharges, Ballast, Tankers, Design and engineering, Monitoring

The major requirements of a practical shipboard monitoring system are outlined. The Societe d'Etude et de Realisation d'Equipementes Speciaux (SERES) Directe Response Ultra-Rapide (DRUR) Type 1 oil content monitor and its onboard installation are described. Typical experience in monitoring tanker effluents is discussed and common problems, especially with the sampling system, are reviewed. Practical experience in regard to compliance with the 1973 International Convention for the Prevention of Pollution from Ships is also discussed.

C-0490-77
STRATEGIES FOR MARINE POLLUTION MONITORING
Goldberg, E. D. 1976.
New York, John Wiley & Sons, 1976. 310p.

Contaminants, Oceans, Hydrocarbons, Tar, Analytical techniques, Sampling, Marine organisms, Monitoring

Methods are described for the analysis of organic marine environmental pollutants including petroleum hydrocarbons, PCB and DDT compounds, low molecular weight hydrocarbons, phthalates, chlorinated hydrocarbons, plastics, pelagic tars and other litter. Discussions of sampling sites, organisms selected for monitoring, and transport paths are included.

[from Pollution Abstracts 8(1):#77-00344. 1977]

C-0491-77
OIL-IN-WATER MONITOR
Grant, M. G. 1976.
U.S. Patent 3,966,603

Monitoring, Wastewaters, Oil-water separation, Patent

An oil-in-water monitor is described which is equipped with sensors that measure the amount of oil, turbidity, and flow rates of effluents from an oil-water separator. If predetermined limits are exceeded, the sensors activate alarms and/or automatically recirculate the effluent.

[from Chemical Abstracts 85(22):#166219h. 1976]

3,966,603
OIL-IN-WATER MONITOR
Michael G. Grant, [illegible], Fredericksburg, Va. 22401
Filed [illegible]
[illegible]
U.S. Cl. 210—96 [illegible] Claims

C-0492-77
DETERMINATION OF OIL CONTENT IN WASTEWATER [in Japanese]
Hagiwara, K. 1976.
Kagaku Kojo 20(7):35-39.

Monitoring, Wastewaters, Detection, Chemical analysis

"A review with 14 references of problems in JIS method of analysis of wastewater containing a low concentration of oils."

[from Chemical Abstracts 86(4):21327c. 1977]

C-0493-77
DEVELOPMENT OF AN OIL-IN-WATER CONTENT MONITOR
Hornig, A. W., J. T. Brownrigg, B. R. Chisholm, L. P. Giering, and R. L. Skewes. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 147-152. (American Petroleum Institute No. 4284)

Monitoring, Hydrocarbons, *Oil-in-water, Design and engineering, *Fluorescence

An oil-in-water content monitor, which utilizes the fluorescence characteristics of aromatic components of petroleum, has been developed by Baird-Atomic, Inc. High sensitivity, real time output, fast response time, insensitivity to interferences, and low sensitivity to particulates are advantages of the technique; unequal luminescence response of various oil components presents the main problem. Two main approaches utilizing this technique are detailed: a synchronous scan monitoring device and a more generally applicable total luminescence monitor (TLS).

C-0494-77
ULTRASONIC POLLUTION MONITOR
Houlihan, T. M., and F. K. McGrath. 1976.
Proceedings of the Institute of Environmental Science No 22:487-490.

Monitoring, Contamination, Ships, Ballast, Bilges

An ultrasonic pollution monitor is described which is capable of accurately measuring oil contamination as low as 22 ppm oil in water. The monitoring system is intended for use on shipboard bilge and ballast waters.

[from Chemical Abstracts 85(22):#166154h. 1976]

C-0495-77
HIGH SEAS OIL POLLUTION: PARTICULATE PETROLEUM RESIDUES IN THE NORTH ATLANTIC
Levy, E. M., and A. Walton. 1976.
Journal of the Fisheries Research Board of Canada 33(12):2781-2791.

Monitoring, Tar, Sampling, Distribution, Atlantic Ocean

Water samples were taken from the North Atlantic over a three year period. Waters north of the Gulf Stream-North Atlantic Current system were virtually free from floating tar; while the waters of the Gulf Stream, Sargasso Sea, and Caribbean Sea were more heavily polluted. The distribution of tar is due to shipping and tanker traffic and surface circulation patterns.

C-0496-77

LEAK DETECTOR APPARATUS

Leybold Heraeus GmbH Company. 1976.
French Patent 2,283,431

Monitoring, Leakage, Detection, Oil tanks, Patent, Design and engineering

An apparatus which is more sensitive and has a faster response time than other leak detectors is described. The device is designed to detect leakage from tanks.

[from Petroleum Abstracts 17(4):#229,351. 1977]

C-0497-77

DISTRIBUTION OF LOW-MOLECULAR-WEIGHT HYDROCARBONS IN SOUTHERN BEAUFORT SEA

Macdonald, R. W. 1976.
Environmental Science and Technology 10(12):1241-1246.

Monitoring, Hydrocarbons, Distribution, Water quality, Beaufort Sea

C_1 and C_4 hydrocarbon concentrations were measured in the Southern Beaufort Sea continental shelf region. Saturated hydrocarbon concentrations were low in contrast to other shelf areas where shipping, ballast dumping, and drilling have occurred; thus, their concentrations could serve as indicators of deteriorating water quality.

C-0498-77

SURVEILLANCE OF THE MARINE ENVIRONMENT FOR HYDROCARBONS

McAuliffe, C. D. 1976.
Marine Science Communications 2(1):13-42.

Monitoring, Hydrocarbons, Oceans, Surveillance, Distribution

Low molecular weight hydrocarbons are found throughout the oceans, approximately in equilibrium with atmospheric CH_4. These gases and C_2H_6 and C_3H_8 found in the top 200 m of water are mostly biogenic. Higher molecular weight hydrocarbons are restricted to the top 10 m of water, principally as particles, with concentrations decreasing from the sea-air interface.

[from Chemical Abstracts 85(24):#182092s. 1976]

C-0499-77
A LIQUID CHROMATOGRAPHIC FLUORESCENCE TECHNIQUE FOR ESTIMATING CRUDE OIL IN WATER, SEDIMENT AND BIOLOGICAL MATERIAL
Miles, D. H., M. J. Coign, and L. R. Brown. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 179-182. (American Petroleum Institute No. 4284)

Monitoring, Crude oil, Detection, Chromatography, Sediments, *Oil-in-water, *Biological materials

A rapid method for detecting and estimating the amount of crude oil in the presence of large amounts of biological material is described. The method involves use of high pressure liquid chromatography with chloroform as the solvent, an excitation wavelength of 403 nm, and an emission wavelength of 418 nm. Results of experiments indicate that even the least responsive oils can be detected at concentrations less than 1 ug and that the method is selective, sensitive, and yields reproducible data.

C-0500-77
FRAMEWORK FOR BUREAU OF LAND MANAGEMENT PROGRAMS
Monastero, F. R. 1976.
Bureau of Land Management's Environmental Studies Program for the South Atlantic Outer Continental Shelf Area, Conference/Workshop Proceedings. M. F. Massoglia (compiler). Research Triangle Park, N.C., Research Triangle Institute, 1976. p. 15-24. Held at Atlanta, 1975.

Monitoring, OCS, Coasts, EIS, Oil-gas leasing, Regulations, BLM, *Environmental Studies Project

BLM's Environmental Studies Project encompasses a broad range of studies designed to gather data on the physical, chemical, biological and geological aspects of the OCS, nearshore and coastal environments. Information from these studies is essential in oil-gas leasing, lease modifications, EIS preparation, and formulation of regulations.

[From Selected Water Resources Abstracts 9(21):#W76-11476. 1976]

C-0501-77

HYDROCARBON POLLUTION MONITORING - A NATIONAL IMPERATIVE

Monastero, F. C. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 108-119. Proceedings of the Symposium, American University, Washington, D.C., 9-11 August 1976.

Monitoring, Hydrocarbons, Oil spills, Pollution control, Surveillance, Government agencies, EPA, USGS, USCG, *UN

Four programs presently in effect which monitor petroleum hydrocarbons in the environment are briefly outlined. Programs are conducted by EPA, Office of Monitoring Systems; U.S. Coast Guard, Pollution Incident Reporting System (PIRS), Transportation Induced Pollution Surveillance System (TIPS), Airborne Remote Surveillance System (ARSS), and Airborne Oil Surveillance System (AOSS); the U.S. Geological Survey petroleum monitoring and compliance inspections program; and the U.N. Intergovernmental Oceanographic Commission (IOC), Integrated Global Ocean Station System (IGOSS).

C-0502-77

OIL DETECTOR ELEMENT

Ohtsu, T., Y. Nakamura, and A. Sugimoto. 1976.
French Patent 2,276,564

Monitoring, Leakage, Pipelines, Oil slicks, Wastewaters, Detection, Design and engineering, Patent

The oil detector consists of a housing with a water-repellent, oil-transmitting filter element mounted in a side opening. The back side of the filter is covered with conducting particles; the two faces of the layer of the particles are connected to electrodes. The device is suitable for a wide variety of applications.

[from Petroleum Abstracts 17(3):#229,120. 1977]

C-0503-77

HYDROCARBON FILM DETECTOR FOR CALM AND AGITATED WATERS

Malet, C., and D. Ralut. 1976.
Belgian Patent 813,640

Monitoring, Hydrocarbons, Detection, Patent, Design and engineering

Hydrocarbons are detected by an electronic conductivity system mounted on a float.

[from Petroleum Abstracts 17(6):#230,168. 1977]

C-0604-77
FEASIBILITY OF CONTINUOUS MONITORING FOR OIL POLLUTION ACROSS CHANNELS AND RIVERS
Rambie, G. S., Jr., R. H. Morgan, and D. R. Jones. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 193-196. (American Petroleum Institute No. 4284)

Monitoring, Oil slicks, Rivers, Design and engineering, *Infrared scanning oil sensor

Several monitoring systems have been developed for detecting oil pollution in channels and rivers and are currently under evaluation. This report describes the characteristics, application, and evaluation of a bistatic active infrared scanning oil sensor under development by Rambie, Inc.

C-0605-77
PETROLEUM AND ANTHROPOGENIC INFLUENCE ON THE COMPOSITION OF SEDIMENTS FROM THE SOUTHERN CALIFORNIA BIGHT
Reed, W. E., I. R. Kaplan, M. Sandstrom, and P. Mankiewicz. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 183-188. (American Petroleum Institute No 4284)

Monitoring, Hydrocarbons, Sediments, Chemical analysis, Source identification, Southern California

Low to high concentrations of petroleum hydrocarbons and various anthropogenic organic chemicals have been detected in nearly all sandy intertidal and benthic sediments collected from the Southern California borderland and have been characterized by gas chromatography and mass spectrometry. Benthic samples showed considerable compositional variations from region to region. Intertidal sediment samples showed variations related to tidal position; samples from low tide levels had the highest hydrocarbon concentrations. Sources of hydrocarbons in the Southern California Bight include anthropogenic sources - municipal and industrial wastes, shipping and oil transport - and inputs from many natural seeps and the organic-rich Tertiary sediments.

C-0506-77

MONITORING OIL CONTENT IN SHIPBOARD WASTE WATER DISCHARGES BY USE OF A MULTI-PHASED DYE TRANSFER PROCESS

Ricci, R. J., and A. M. Kelley. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 161-164. (American Petroleum Institute No. 4284)

Monitoring, Oil discharges, Wastewater, Ships, Design and engineering, USN, *Oil content

A new process for oil-in-water monitoring in the 1-200 ppm range has been developed by the U.S. Navy and engineered into a portable, compact and low-cost shipboard instrument package. The system reliably and accurately measures oil content irrespective of the type of oil or the presence of solids, detergents and other contaminants. Instrument prototype evaluation and continuing development of the system are described.

C-0507-77

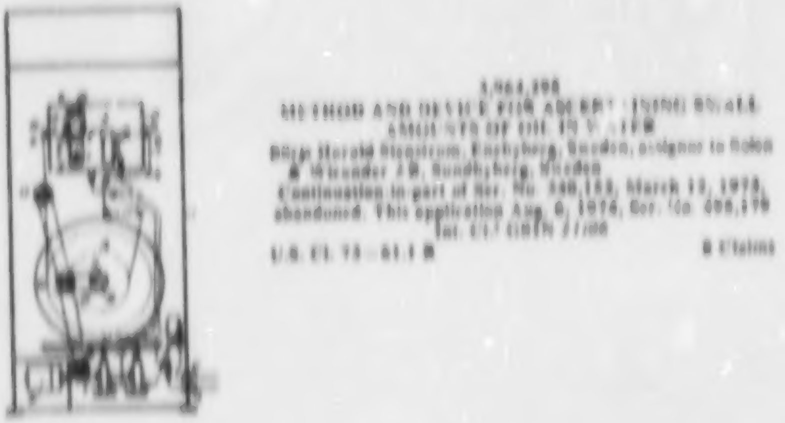
METHOD AND DEVICE FOR ASCERTAINING SMALL AMOUNTS OF OIL IN WATER

Stenstrom, B. H. 1976.
U.S. Patent 3,964,295

Monitoring, Wastewaters, Bilges, Ships, Oil-water separation, Patent

A defined amount of water is removed so as to concentrate the oil and then the oil content is measured. The oil is concentrated by passing a predetermined amount of oily water per unit of time through a determined area of a filter material which absorbs or separates oil. Oil content is measured photo-electrically by determination of the color change of the oil-absorbing filter material.

[from Selected Water Resources Abstracts 9(24):W76-13156. 1976]



3,964,295
METHOD AND DEVICE FOR ASCERTAINING SMALL AMOUNTS OF OIL IN WATER

C-0508-77
DESIGNING WATER POLLUTION DETECTION SYSTEMS - ENVIRONMENTAL LAW ENFORCEMENT ON THE U.S. COASTAL WATERS AND THE GREAT LAKES
Wright, G. P., and D. G. Olson. 1975.
Chichester, England, John Wiley and Sons, Ltd., 1975. 228p.

Remote sensing, Oil spills, Ships, Surveillance, Design and engineering, Law enforcement, Environmental protection, USCG

This book is the result of a study on designing an effective airborne pollution detection and surveillance system for the U.S. Coast Guard. Chapter 1 explains the scope of the environmental protection and enforcement program. Chapter 2 evaluates pollution surveillance effectiveness and the allocation of resources. The third and fourth chapters present data on petroleum shipping in U.S. waters and pollution incident statistics from 1965 to 1972. An overview of oil and hazardous materials detection methods is given in Chapter 5, and computer applications to pollution surveillance are detailed in Chapter 6.

[from Water, Air and Soil Pollution 6(3):372. 1976]

C-0509-77
BIOGENIC HYDROCARBONS IN INTERTIDAL COMMUNITIES
Zsolnay, A., H. G. Maynard, and E. D. Gebelein. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 173-177. (American Petroleum Institute No. 4284)

Monitoring, Hydrocarbons, Marine organisms, Intertidal zone, Chemical analysis, Chromatography, Metabolism, *Biogenic hydrocarbons

Littoral marine flora and fauna from Bermuda were monitored for biogenic hydrocarbon content from late 1974 to early 1976; the hydrocarbons were characterized, differentiated from petroleum hydrocarbons, and quantified by gas-liquid chromatography. Experimental procedures used are reviewed. Macroalgae and algal mats had a mean of 35.5 ug/g of biogenic hydrocarbons and the invertebrates had a mean content of 10.5 ug/g (except for the barnacle *Chthamalus stellatus* with 108.0 ug/g). Present data do not clearly indicate whether the invertebrates are actively synthesizing the hydrocarbons, or simply incorporating them from their food sources.

3. REMOTE SENSING

C-0510-77
EEC REMOTE SENSING OF POLLUTION (news brief)
Anon. 1976.
Marine Pollution Bulletin 7(12):219.

Remote sensing, Contaminants, Oil slicks, Coasts, Europe, *Nimbus satellite

American and European scientists met in September, 1976, to discuss the EURASEP project (Europe Association of Scientists for Experiments with Pollution). The European Commission is interested in collaborating with the U.S. on the use of the Nimbus satellite for remote sensing of coastal water pollution. Among the applications of the satellite are detection of oil slicks at sea and industrial waste in estuaries.

C-0511-77
SATELLITE SENTINEL FOR OIL SPILLS IN 1978?
Hovis, W. A., and D. R. Jones. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 211-214. (American Petroleum Institute No. 4284)

Remote sensing, Oil slicks, Detection, Surveillance, Natural seepage, Santa Barbara Channel

The limited capabilities of existing satellite remote sensing systems for monitoring oil slicks are discussed. The much greater oil spill detection and surveillance capability of the proposed Coastal Zone Color Scanner (CZCS), designed to be onboard Nimbus G in 1978, is described. Preliminary tests of the CZCS in NASA U-2 high altitude flights have demonstrated a capacity for detecting natural seepage off Coal Oil Point near Santa Barbara. More testing of the CZCS is urged.

C-512-77
AERIAL PHOTOGRAPHIC APPLICATIONS IN SUPPORT OF OIL SPILL CLEANUP, CONTROL AND PREVENTION
Jones, D. R., R. Landers, and A. Pressman. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 221-222. (American Petroleum Institute No. 4284)

Remote sensing, Oil spills, Pollution control, Cleanup, Law enforcement, EPA

Environmental Protection Agency sponsored aerial reconnaisance and mapping of oil spills and oil contamination has been carried out over several years. This paper briefly outlines the scope and purpose of the ongoing pollution surveillance and compliance monitoring program.

C-0513-77
REMOTE SENSING OF OIL SLICKS WITH MICROWAVE RADIOMETER
Kaski, K., and A. Lanaeperi. 1976.
REPT-S-83. 18p.

Remote sensing, Oil slicks, Detection, Source identification, *Microwave radiometry

Oil slicks on the sea surface were detected, mapped, and identified through the use of microwave radiometry. The performance of this technique is assessed and experimental results are reported.

[from Scientific and Technical Aerospace Reports 14(22):#N76-31722. 1976]

C-0514-77
ESTUARINE DENSITY FRONTS AND THEIR EFFECTS ON OIL SLICKS
Klemas, V., D. Polis, and G. Davis. 1976.
NASA-CR-148518; Contract NAS5-20983. 3p.

Remote sensing, Estuaries, *Fronts, Delaware Bay, Oil slicks, Drift, Spreading, Models

Landsat imagery was used to determine the location and extent of estuarine frontal systems over all portions of the tidal cycle. These fronts represent regions of extremely high gradient or discontinuity in water velocity and density fields. Boats were used in Delaware Bay to study the behavior of front parameters and their effect on pollutants in order to provide a basis for improving an oil drift and spreading model.

[from Government Reports Announcements 76(22):#E76-10441. 1976]

C-0515-77
COMPARATIVE EVALUATION OF REAL AND SYNTHETIC APERTURE RADARS FOR THE DETECTION OF OIL POLLUTION IN THE SANTA BARBARA CHANNEL
Kraus, S. P., J. E. Estes, and R. R. Vollmers. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 203-208. (American Petroleum Institute No 4284)

Remote sensing, Detection, Oil slicks, Natural seepage, Platforms, Santa Barbara Channel, USCG, *Side-looking radar

A series of U.S. Coast Guard-sponsored tests were conducted in the Santa Barbara Channel during May, 1976, to evaluate the oil detection and surface target sensing capabilities of two Motorola side-looking radar systems: a real aperture AN/APS-94D, and a synthetic aperture coherent-on-receive (COR). Among the test targets of coincident overflights were natural seeps, induced simulated oil slicks and offshore platforms. Based on 10 coincident flights, COR provided better detection of natural and manmade slicks, while the APS-94D consistently exhibited better surface target resolution results.

C-0516-77
U.S. COAST GUARD AIRBORNE OIL SURVEILLANCE SYSTEM STATUS REPORT
Maurer, A. T., A. T. Edgerton, and D. C. Meeks. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 215-220. (American Petroleum Institute No. 4284)

Remote sensing, Oil spills, Detection, Surveillance, USCG, *Airborne coastal patrol

Evaluation of a U.S. Coast Guard prototype operational airborne coastal patrol system has been completed. This paper describes (1) results of prototype operational evaluation, (2) operational configuration of the C-130 aircraft in which the sensor equipment will be installed for deployment, and (3) future plans for the system.

C-0517-77
THE DETECTION AND MAPPING OF OIL ON A MARSHY AREA BY A REMOTE LUMINESCENT SENSOR
McFarlane, C., and R. Watson. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 197-202. (American Petroleum Institute No. 4284)

Remote sensing, Detection, Oil spills, Marshes, Contamination, *Remote luminescent sensor

An airborne luminescence detector with a Fraunhofer Line Discriminator was flown over a marshy area in Louisiana which had been heavily contaminated by an oil well blowout. Good correlation was observed between the remote sensing and ground truth data. The feasibility of using this instrument for delineating and assessing oil contamination levels and ecological damage is discussed.

C-0518-77
EVALUATION OF OPTICAL TECHNIQUES FOR REMOTE SENSING OF OIL SPILLS IN THE BEAUFORT SEA
McNeil, W. R. and P. A. Lapp. 1976.
Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, 1975. Ottawa, Ontario, Canadian Aeronautics and Space Institute, 1976. p. 297-308.

Remote sensing, Oil spills, Beaufort Sea, *Optical techniques

Meteorological and ice climatalogical conditions and remote sensing objectives need to be considered in selecting optical techniques. Three broadly defined electro-optical sensor classes, photometric, intensified photometric and thermal, are evaluated in terms of their "effective probability" for target registration.

[from The Engineering Index 14(12):#086715. 1976]

C-0519-77
CURRENT APPLICATIONS OF REMOTE OIL MONITORING EQUIPMENT
Wright, J. A. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 209-210. (American Petroleum Institute No. 4284)

Remote sensing, Refineries, Wastewaters, Monitoring, Oil slicks

Industrial experience shows that single-point monitoring of wastewater stream surfaces using an infrared reflectance instrument effectively detects oil films associated with oil concentrations in water as low as 1 ppm. Four case histories of installations in petroleum refineries and industrial plants illustrate the application of this monitoring system.

4. SAMPLING

C-0520-77

NONVOLATILE HYDROCARBONS IN THE PACIFIC OCEAN

Brown, R. A., and T. D. Searl. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 239-255
Proceedings of the Symposium, American University, Washington, D.C., 9-11 August 1976.

Sampling, Hydrocarbons, Chemical analysis, Pacific Ocean, *Tanker routes

To obtain baseline data on the Pacific Ocean, extractable organics and nonvolatile (C_{14}+) hydrocarbons were quantified and characterized from over 300 samples taken along 27,000 km (17,000 mi) of tanker routes. The hydrocarbons were complex mixtures which appeared to be of both biogenic and petroleum origin. A natural background of 1.5 ppb hydrocarbons occurs in ocean surface waters based on data from this and other studies.

C-0521-77

DISTRIBUTION OF VOLATILE HYDROCARBONS IN SOME PACIFIC OCEAN WATERS

Koons, C. B. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 589-592. (American Petroleum Institute No. 4284)

Sampling, Hydrocarbons, Distribution, Pacific Ocean, *Tanker routes

Distributions of volatile C_4 to C_8 hydrocarbons were sampled in 1974 along three major Pacific tanker routes: San Francisco - Cook Inlet, Alaska; San Francisco - Panama; and San Francisco - Singapore. Of the 138 surface and 10 m-deep samples taken, median concentrations were 0.33 ppb (by weight) and 0.10 ppb, respectively. Sampling and analytical procedures are briefly described, and pertinent data are presented. These data indicate that the highest concentrations occur along the San Francisco - Cook Inlet route.

C-0522-77
HYDROCARBONS IN THE NORTHEASTERN GULF OF MEXICO SEDIMENTS
Lytle, T. F., J. S. Lytle, P. J. Gearing, and J. N. Gearing. 1976.
Journal of the Mississippi Academy of Science 20(Supplement):8.

Sampling, Hydrocarbons, Sediments, Chemical analysis, Sources, Distribution, Gulf of Mexico

Sediments collected from 65 locations were analyzed for aliphatic and aromatic hydrocarbons. Only sediments from offshore Mississippi-Louisiana exhibited evidence of terrestrial input. Characteristic unresolved envelopes, distributions of aliphatic hydrocarbons, pristane/phytane ratios, and other calculated parameters were used to designate possible petroleum pollution areas.

[from Bioresearch Index 12(12):#92074. 1976]

C-0523-77
EPIFAUNA AT JACKSON POINT IN PORT VALDEZ, ALASKA, DECEMBER 1970 THROUGH SEPTEMBER 1972
Nauman, J. W., and D. R. Kernodle. 1976.
Journal of the Research of the U.S. Geological Survey 4(3):299-304.

Sampling, Benthos, Estuaries, Water quality, Alaska, *Epifauna

A biological sampling program at Jackson Point (proposed oil terminal site) was begun in December, 1970. Results of the sampling operations for the two-year period are given. Diversity values were lower during 1972, except for the spring sample. Seasonal diversity varied from 0.36 in the summer of 1972 to 3.99 in the fall of 1971.

[from Selected Water Resources Abstracts 9(24):#W76-13070. 1976]

C-0524-77
MICRO-ORGANISMS AND HYDROCARBONS IN THE NORTH SEA DURING JULY-AUGUST, 1976
Oppenheimer, C. H., W. Gunkel, and G. Gassmann. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 593-610. (American Petroleum Institute No. 4284)

Sampling, Hydrocarbons, Distribution, Microorganisms, Bacteria, Tar, Sediments, Offshore development, North Sea

As a part of a cooperative program to determine the ecological effects of North Sea and offshore Louisiana oil development and exploitation, the title study was undertaken to determine the distribution of hydrocarbons and their interaction with microorganisms of the North Sea oil field areas. This report presents preliminary analyses of cruise data relating to abundance of microorganisms at the water surface, at 10 m depth and in bottom sediments; ratios of oil degrading bacteria to heterotrophs; and distribution of hydrocarbons and tar balls in water and sediments.

C-0525-77

EXTRACTABLE ORGANICS AND NONVOLATILE HYDROCARBONS IN NEW YORK HARBOR WATERS

Searl, T. D., H. L. Huffman, Jr., and J. P. Thomas. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 583-588. (American Petroleum Institute No. 4284)

Sampling, Hydrocarbons, *Extractable organics, Harbors, New York, Contamination, Distribution

Selected stations in New York Harbor were sampled in November, 1974, and March-June, 1975, for carbon tetrachloride-extractable organics and nonvolatile hydrocarbons. Average contaminant concentrations were about one order of magnitude higher than those reported for open ocean. Diversity patterns and regional variations are reported and tabulated; some variations in the ratio of hydrocarbons to other organics are attributed to oxidation and/or adsorption and precipitation of hydrocarbons.

C-0526-77

HYDROCARBON UPTAKE BY DEEP SEA BENTHOS

Teal, J. M. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 358-372. Proceedings of the Symposium, American University, Washington, D.C., 9-11 August 1976.

Sampling, Hydrocarbons, Sediments, Benthos, Uptake, Chemical analysis, Tar, *Abyssal depths

Hydrocarbons were analyzed from sediments and benthic animals collected at abyssal depths of 5500 m to 5800 m, and the preliminary results are presented. Petroleum hydrocarbons were found in some of the samples and found to be similar to those found in tar balls.

5. ANALYSIS

C-0527-77
EVALUATION OF CHEMICAL, SPECTROSCOPIC AND CHROMATOGRAPHIC METHODS USED TO IDENTIFY OFFSHORE OIL POLLUTANTS [English summary]
Albaiges, J., J. Rivera, J. M. Torrades, and M. R. Cuberes. 1976.
Revue de l'Institut Francais du Petrole 31(3):427-450.

Oil slicks, Chemical analysis, Chromatography, Spectroscopy, Detection

Various methods used to identify the leading petroleum pollutants of the sea by quantitative analysis of their passive markers and by determining other intrinsic properties are reviewed.

[from Petroleum Abstracts 16(48):#227,465. 1976]

C-0528-77
DETERMINATION OF THE CONTENT OF PETROLEUM PRODUCTS IN A FILM FLOATING ON THE SEA SURFACE [English summary]
Anufrieva, N. M., A. B. Gornitsky, M. P. Nesterova, and I. A. Nemirovskaya. 1976.
Okeanologiya 16(2):255-258.

Oil slicks, Petroleum products, Detection, Analytical techniques, Absorption

Oil from an oil slick was first absorbed by a piece of polyurethane foam, extracted by CCl_4, and the petroleum product content was then determined by infrared absorption at 2700-3200 cm^{-1}. Results of five samples are presented.

[from Chemical Abstracts 85(22):#166386k. 1976]

C-0529-77
CHARACTERIZATION OF PETROLEUM HYDROCARBONS IN THE MARINE ENVIRONMENT
Bean, R. M. 1975.
Pacific Northwest Laboratory Annual Report for 1974, BNWL-1950, Pt. 2. p. 113.

Hydrocarbons, Chemical analysis, Chromatography, Seawater

Biological studies have increased the demand for more rapid and detailed information concerning the nature and concentration of hydrocarbons in water. Results are given of gas chromatographic analyses conducted at the Marine Research Labs, Sequim, Washington, to determine the actual distribution of individual hydrocarbon compounds in seawater.

C-0530-77
CHEMICAL INVESTIGATIONS OF TWO EXPERIMENTAL OIL SPILLS IN AN ESTUARINE ECOSYSTEM
Bieri, R. H., V. C. Stamoudis, and M. K. Cueman. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 511-516. (American Petroleum Institute No. 4284)

Oil spills, Eytuaries, Chemical analysis, Fishes, Fate, Hydrocarbons, Weathering, *_Fundulus heteroclitus_

The fate of fresh and artificially weathered South Louisiana crude oil was studied in large-scale experimental oil spills. The article focuses on hydrocarbon analyses in the fish, _Fundulus heteroclitus_, and water. Maximum concentrations of individual aromatic compounds found in fish were similar for both oils. The maximum occurred six hours after the spill for weathered crude, and 76 hours after the spill for fresh crude for all aromatics except naphthalene and the methylnaphthalenes.

C-0531-77
THE CHARACTERIZATION OF TRACE ORGANIC CONSTITUENTS IN PETROLEUM REFINERY WASTEWATER BY CAPILLARY GAS CHROMATOGRAPHY/REAL-TIME HIGH-RESOLUTION MASS SPECTROMETRY-A PRELIMINARY REPORT
Burlingame, A. L., B. J. Kimble, E. S. Scott, D. M. Wilson, M. J. Stasch, J. W. DeLeeuw, and L. H. Keith. 1976.
Identification and Analysis of Organic Pollutants in Water. p. 587-624. L. H. Keith (ed.) Ann Arbor, Michigan, Ann Arbor Science Publishers, 1976. Chemical Congress of the North American Continent, 1st, 1975.

Wastewaters, Refineries, Analytical techniques, Chromstography, Spectrometry

Gas chromatography/high-resolution mass spectroscopy provides valuable information on organic constituents of refinery effluents, even when these occur as extremely complex mixtures.

[from Chemical Abstracts 85(22):#166166p. 1976]

C-0532-77
HYDROCARBONS FROM ZOOPLANKTON OF THE EASTERN GULF OF MEXICO
Calder, J. A. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 153-183. Proceedings of the Symposium, American University, Washington, D.C., 9-11 August, 1976.

Hydrocarbons, Zooplankton, Chemical analysis, Sources, Distribution, Gulf of Mexico, *Biogenic hydrocarbons

Four sets of seasonal zooplankton samples were collected in transits along the offshore Mississippi-Alabama-Florida (MAFLA) region of the

Gulf of Mexico; the contained hydrocarbons were analyzed and quantified. No fresh or weathered petroleum fractions were found in the zooplankton, and the hydrocarbons present appear to be of biogenic origin.

C-0533-77
EUROPEAN COMMUNITY STUDY ON THE DETERMINATION OF CYANIDES, PHENOLS, AND HYDROCARBONS IN SURFACE WATER. REPORT OF A WORKING GROUP OF EXPERTS
Commission of the European Communities. 1975.
Luxembourg, Directorate for Health Protection. NTIS No. EUR-5377e. 78p.

Chemical analysis, Hydrocarbons, *Phenols, *Surface waters

Thirty-four laboratories from eight European states conducted the preliminary collaborative study. An appraisal of the particular methods of analysis employed by each laboratory could not be done. It was found that the determination of hydrocarbons and cyanides in surface water may lead to considerably different results. In the given concentration range, phenol determinations showed the smallest variation of all parameters studied.

[from ERDA Energy Research Abstracts 1(7):#011476. 1976]

C-0534-77
GAS-CHROMATOGRAPHIC ANALYSIS IN WASTE CHEMISTRY
Dell'Acqua, R. 1975.
Chromatographic Analysis of the Environment. R. L. Grob (ed.). New York, Marcel Dekker, Inc., 1975. p. 581-609.

Chemical analysis, Chromatography, Contaminants, Wastewaters, Petroleum products, Petrochemicals, *Gas chromatography

The optimal analytical methods for quantifying organic contaminants present in wastewater by gas chromatography are reviewed. Gasoline, kerosine, fuel oils, lubricating oils, and certain refinery and petrochemical byproducts are among the pollutants considered.

C-0535-77
IDENTIFICATION OF GASOLINE CONTAMINATION OF GROUNDWATER BY GAS CHROMATOGRAPHY
Dell'Aqua, R., B. Bush, and J. Egan. 1976.
Journal of Chromatography 128(2):271-280.

Gasoline, Chemical analysis, Chromatography, Groundwater, Contamination

A method of extraction and identification of gasoline is described which may be used to identify a source causing contamination at a level as low as 0.5 µl/l. The method employs gas chromatography using packed columns and a flame ionization detector.

C-0536-77
THE SOLUBILITY OF MEDIUM MOLECULAR WEIGHT AROMATIC HYDROCARBONS AND THE EFFECTS OF HYDROCARBON CO-SOLUTES AND SALINITY
Eganhouse, R. P., and J. A. Calder. 1976.
Geochimica et Cosmochimica Acta 40(5):555-561.

Aromatic hydrocarbons, Chemical analysis, Solubility

The solubilities of several medium molecular weight hydrocarbons were determined at 25°C in aqueous binary, ternary, and quaternary hydrocarbon system. Solubility limits of the hydrocarbons depend on the composition of the petroleum from which they are derived.

C-0537-77
INTERCALIBRATION OF GAS CHROMATOGRAPHIC ANALYSES FOR HYDROCARBONS IN TISSUES AND EXTRACTS OF MARINE ORGANISMS
Farrington, J. W., J. M. Teal, G. C. Medeiros, K. A. Burns, E. A. Robinson, Jr., J. G. Quinn, and T. L. Wade. 1976.
Analytical Chemistry 48(12):1711-1716.

Hydrocarbons, Marine organisms, Chemical analysis, Chromatography, Fish

Analyses of petroleum hydrocarbons separated from tuna meal samples and cod liver lipid extracts were performed using gas chromatography. Measured values of hydrocarbons spiked to samples of cod liver oil are presented. Limitations to current methods of analysis used in this and other current studies are discussed.

C-0538-77
PETROLEUM HYDROCARBONS
Farrington, J. W., J. M. Teal, and P. L. Parker. 1976.
Strategies for Marine Pollution Monitoring. E. D. Goldberg (ed.). New York, John Wiley & Sons, Inc., 1976. p. 3-34.

Hydrocarbons, Oceans, Chemical analysis, Sampling

In this chapter, the authors set forth principles for the analysis of marine samples for petroleum hydrocarbons with a boiling range above n-tetradecane. Continuing research needs in the measurement of petroleum hydrocarbons are noted. One point underlined is that sampling, analysis, and interpretation of data are best accomplished by a team of scientists or a scientist having experience in analytical chemistry, marine geochemistry, marine biochemistry, and marine ecology.

C-0539-77
HYDROCARBONS IN 60 NORTHEAST GULF OF MEXICO SHELF SEDIMENTS:
A PRELIMINARY SURVEY
Gearing, P., J. N. Gearing, T. F. Lytle, and J. S. Lytle. 1976.
Geochimica et Cosmochimica Acta 40(9):1005-1017.

Hydrocarbons, Sediments, Algae, Chromatography, Gulf of Mexico, Mississippi River, Sampling

Gas chromatography was used to analyze 60 sediment and 10 benthic algae samples in the northeast Gulf of Mexico. Results show two distinct shelf environments: one, a western zone dominated by hydrocarbon inputs from the Mississippi River and two, a zone extending from northwest Florida to Tampa dominated by hydrocarbons similar to those produced by marine organisms.

C-0540-77
DISTRIBUTION OF N-PARRAFINS [sic] IN SELECTED MARINE BENTHIC ORGANISMS
Giam, C.-S., H. S. Chan, and G. S. Neff. 1976.
Bulletin of Environmental Contamination and Toxicology 16(1):37-44.

Hydrocarbons, Marine organisms, Chemical analysis, Chromatography, Fish, *Shrimp, *Squid, *n-Paraffins

Shrimp, fish and squid from the Texas OCS area of the Gulf of Mexico were analyzed by gas chromatography for the presence of n-paraffins. Squid and fish contained relatively high concentrations of C_{15} and C_{17} n-paraffins. Shrimp and fish samples exhibited the least intraspecies and seasonal variations in their distribution of n-paraffins and are considered very useful for the detection of petroleum-based hydrocarbon pollution.

C-0541-77
CHARACTERIZATION OF INDUSTRIAL ORGANIC COMPOUNDS IN WATER
Goodley, P. C., and M. Gordon. 1976.
Transactions, Kentucky Academy of Science 37(1-2):11-15.

Chemical analysis, Hydrocarbons, *Industrial organic compounds, *Tennessee River

Waters from the Lower Tennessee River analyzed by gas chromatography, mass spectrometry, and infrared and NMR spectroscopy were found to contain aromatic and aliphatic hydrocarbons, phenols and other substances.

[From Chemical Abstracts 86(4): #21623w. 1977]

C-0542-77
CHROMATOGRAPHIC ANALYSIS OF THE ENVIRONMENT
Grob, R. L. (ed.). 1975.
New York, Marcel Dekker, Inc., 1975. xi + 734p.

Chemical analysis, Chromatography, Hydrocarbons, Petroleum products, Petrochemicals, Fuels, Wastewaters

This book provides a comprehensive review of various chromatographic techniques for determining contaminants in the air, water, waste effluents, and soil. The sections on water pollution (Part IV) and waste chemistry (Part V) include discussions of specific chromatographic techniques useful in the identification and characterization of petroleum hydrocarbons, petroleum-based fuels and lubricants, and petrochemical and petroleum industry wastes.

C-0543-77
A REVIEW OF SOME COMMONLY USED PARAMETERS FOR THE DETERMINATION OF OIL POLLUTION
Gruenfeld, M., and U. Frank. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 487-491. (American Petroleum Institute No. 4284)

Hydrocarbons, Detection, Analytical techniques

Parameters of petroleum used in the detection of oil in water, sediments and biological tissues are outlined, and a brief state-of-the-art review is presented of techniques used in the analysis and characterization of pollutant petroleum hydrocarbons.

C-0544-77
HIGH-PRESSURE LIQUID CHROMATOGRAPHY OF BENZO(A)PYRENE AND BENZO (GHI)PERYLENE IN OIL-CONTAMINATED SHELLFISH
Guerrero, H., E. R. Biehl, and C. T. Kenner. 1976.
Journal of the Association of Official Analytical Chemists 59(5): 989-992.

Chemical analysis, Chromatography, PAH, Marine organisms, *Shellfish

In the title analysis, the polynuclear aromatics are extracted with acetonitrile and partitioned into petroleum ether, the petroleum ether is removed, and the residue is saponified. The compounds are purified and isolated by passing the residue through a silica gel column and a high-pressure liquid chromatographic column, and detected by their ultraviolet absorption. Recoveries of standards through the analysis averaged 104%.

C-0545-77
LIQUID CHROMATOGRAPHIC ANALYSES IN WASTE CHEMISTRY
Hamilton, C. E. 1975.
Chromatographic Analysis of the Environment. R. L. Grob (ed.), New York, Marcel Dekker, Inc., 1975. p. 581-609.

Chemical analysis, Chromatography, Contaminants, Hydrocarbons, Wastewaters, *Liquid chromatography

The usefulness of conventional liquid chromatography (LC) is assessed for the analysis of organic contaminants, including certin petroleum hydrocarbons. The technique is presently limited in its applications because of poor reproducibility of results and low accuracy, speed and selectivity.

C-0546-77
ANALYSIS OF MICROGRAM/KG (PPB) LEVEL HYDROCARBONS IN INTERTIDAL ZONE SEDIMENTS AND WATER BY GAS CHROMATOGRAPHY-MASS SPECTROMETRY
Hertz, H. S., W. E. May, S. N. Chesler, and B. H. Gump. 1975.
Annual Conference on Mass Spectrometry and Allied Topics, 23rd, Houston, 1975. p. 663-665.

Hydrocarbons, Chemical analysis, Chromatography, Spectrometry, Sediments, Intertidal zone, *Water analysis

Techniques involving dynamic headspace sampling and subsequent GC/GC-MS analysis have been developed in this laboratory. Sample components are separated from the matrix in a closed system and concentrated on a porous polymer pre-column, free from large amounts of solvent and ready for GC-MS analysis. Applications of this method to the identification of microgram/kg level hydrocarbons are discussed.

[from Government Reports Announcements 76(25):#PB-257 922/5GA. 1976]

C-0547-77
DIRECT ANALYSIS OF ORGANIC COMPOUNDS IN AQUEOUS BYPRODUCTS FROM FOSSIL FUEL CONVERSION PROCESSES: OIL SHALE RETORTING, SYNTHANE COAL GASIFICATION AND COED COAL LIQUEFACTION
Ho, C. H., B. R. Clark, and M. R. Guerin. 1976.
Journal of Environmental Science and Health A11(7):481-489.

Oil shale, Extraction, Analytical techniques, Chromatography, Contaminants, *By-product waters

An analytical technique is described for the rapid determination of contaminants occurring in the by-product water from oil shale retorting, coal gasification and coal liquefaction processes. Results of the technique, which utilizes gas chromatography, are presented.

C-0548-77

MEASUREMENT OF URBAN RUNOFF PETROLEUM

Hunter, J. V., S. L. Yu, and W. Whipple, Jr. 1975.
Urbanization and Water Quality Control. W. Whipple, Jr. (ed.).
Minneapolis, Minnesota, American Water Resources Association,
1975. p. 162-168.

Wastewaters, Refineries, Hydrocarbons, Delaware, *Oil content, *Urban runoff, *Delaware Estuary

Samples of urban storm runoff into the Delaware Estuary were analyzed to determine petroleum contents of urban runoff and to assess the relative importance of urban runoff and refinery effluent inputs. Average concentrations of hydrocarbons ranged from about 2-4 mg/l in runoff; hydrocarbons were predominantly aliphatic and associated with particulate matter. Refinery effluent hydrocarbon concentrations averaged about 1.5 mg/l, or 80 percent of the average concentrations of urban runoff; these were also predominantly aliphatic and associated with particulates.

C-0549-77

EFFECTS OF WATER POLLUTED BY OIL ON AQUATIC ANIMALS: III PRETREATMENT IN DETECTION OF N-PARAFFINS IN MARINE SEDIMENTS BY GAS CHROMATOGRAPHY

Motohiro, T., and Z. Iseya. 1976.
Hokkaido Daigaku, Sapporo, Japan. Suisangakubu, Hakodate.
Hokkaido Daigaku Suisangakubu Kenkyo Iho 26(4):372-380.

Detection, Hydrocarbons, Sediments, Chemical analysis, Chromatography, Solvents, *n-Paraffins

Preliminary treatments by column and thin-layer chromatography (TLC) were conducted using solvents with different polarities. Petroleum ether + benzene = 90:10 (v/v) for column chromatography and n-hexane + benzene = 95:5 (v/v) for TLC were more efficient than other tested solvents in separating n-paraffins from contaminants. With pretreatment, n-paraffins below C_{13} tend to disappear due to evaporation losses.

[from Pollution Abstracts 8(1):#77-00276. 1977]

C-0550-77
ORGANIC SULFUR COMPOUNDS IN THE FLESH OF EELS REARED IN CRUDE OIL SUSPENSIONS [in Japanese]
Ogata, M. Y. Miyake, K. Matsunaga, M. Imanaka, M. Ikeda, and T. Ishada. 1976.
Igaku to Seibutsugaku 92(4):297-299.

Chemical analysis, Chromatography, Hydrocarbons, Crude oil, *Eels, *Organic sulfides

"Paraffin hydrocarbons together with organic sulfides were detected in eels after a 17-day exposure to water containing crude oil as detected by gas-liquid chromatography."

[from Chemical Abstracts 86(7):#38257c. 1977]

C-0551-77
ANALYZER OF PETROLEUM PRODUCT CONTENT IN WASTE WATERS AND ITS METEOROLOGICAL ATTESTATION [in Russian]
Osipov, V. M., A. V. Cheftsov, Y. M. Lindenbaum, V. V. Luchinskii, and V. D. Grigor'ev. 1976.
Zhurnal Prikl. Spektrosk. 25(2):301-305.

Chemical analysis, Petroleum products, Wastewaters, Monitoring

Petroleum products (1-1000 mg/1) in wastewater were extracted with CCl_4 and analyzed. Results of infrared monitoring are presented.

[from Chemical Abstracts 86(4):21442m. 1977]

C-0552-77
PETROLEUM POLLUTION: CHEMICAL CHARACTERISTICS AND BIOLOGICAL EFFECTS
Parker, P. L., K. Winters, C. VanBaalen, J. C. Batterton, and R. C. Scalan. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 256-269. Proceedings of the Symposium, American University, Washington, D.C., 9-11 August 1976.

Biological effects, Contamination, Chemical analyis, Crude oil, Hydrocarbons, *Water-soluble fractions

In this study the problems of the biological effects of petroleum pollution have been approached in two ways: (1) the study of the chemical composition of water-soluble fractions (WSFs) of crude oil and their physical and biological transport in the water column, and (2) identification and quantification of the types and levels of heavy hydrocarbons in the sea.

C-0553-77

ANALYSIS OF OIL, OIL DISPERSANTS AND METABOLITES DURING BIODEGRADATION IN SEAWATER

Penrose, W. R., L. L. Dawe, and M. J. Sandeman. [1976.]
Trace Analysis of Environmental Materials. p. 13. Program and abstracts.

Dispersants, Chemical analysis, Biodegradation, Seawater

Described are procedures which have been developed to identify a series of commercial oil dispersants and to establish the mechanism of biodegradation of the dispersants in seawater.

[from Pollution Abstracts 8(1):#77-00373. 1977]

C-0554-77

OIL AND GREASE ANALYSIS OF DRILLING MUDS. AN INVESTIGATION OF THE RELIABILITY AND CONFIDENCE INTERVALS OF STANDARD WATER QUALITY ANALYSIS METHODS AS THEY APPLY TO THE DRILLING MUDS

Strosher, M., and J. Bogner. 1976.
Report to the Water Pollution Control Section, Canada, Environmental Protection Service. 16p.

Drilling, Analytical techniques, Water quality, *Drilling muds

Summary not available.

[from Kananaskis, University of Calgary, Alberta, Canada. IB No. 9. Publication No. 75-14. March 31, 1976]

C-0555-77

LIQUID CHROMATOGRAPHIC ANALYSIS IN WATER POLLUTION

Suffett, I. H., and E. J. Sowinski. 1975.
Chromatographic Analysis of the Environment. R. L. Grob (ed.). New York, Marcel Dekker, Inc. 1975. p. 429-488.

Chemical analysis, Chromatography, Petroleum products, PAH, Refineries, Wastewaters, *Liquid chromatography

The application of various liquid chromatography (LC) techniques for identifying and quantifying trace amounts of organic pollutants in water is outlined. Included is a tabulation of LC techniques for characterizing petroleum products, polycyclic hydrocarbons, refinery effluents, and oily wastewaters.

C-0556-77
SOLUBILITY OF ALKYLBENZENES IN DISTILLED WATER AND SEAWATER AT 25.0°C
Sutton, C., and J. A. Calder. 1975.
Journal of Chemical & Engineering Data 20(3):320-322.

Chemical analysis, Aromatic hydrocarbons, Solubility, *Alkylbenzenes

Results indicated that for monosubstituted alkylbenzenes, the size of the alkyl substituent is important in determining the solubility; whereas for polysubstituted alkylbenzenes, the positions of the substituents on the benzene ring are also important.

C-0557-77
AUTOMATIC ANALYZER FOR TRACES OF DISPERSED OILS IN WASTE WATER USING SOLVENT EXTRACTION AND INFRARED SPECTROPHOTOMETRY [English summary]
Suzuki, R., H. Yamaguchi, and R. Matsumoto. 1976.
Bunseki Kagaku 25(5):308-313.

Wastewaters, Chemical analysis, Contaminants, *Solvent extraction, *IR spectrophotometry

An automatic analyzer is described which detects ≥ 0.5 ppm mineral oil, fatty oil, and fatty acids in wastewater.

[From Chemical Abstracts 85(22):#166062b. 1976]

C-0558-77
THIN-LAYER CHROMATOGRAPHIC ANALYSIS IN SOIL CHEMISTRY
Thornburg, W. 1975.
Chromatographic Analysis of the Environment. R. L. Grob (ed.).
New York, Marcel Dekker, Inc., 1975. p. 581-609.

Chemical analysis, Chromatography, Hydrocarbons, PAH, Soil, *Thin-layer chromatography

Techniques and applications of thin layer chromatography (TLC) in soil analysis are reviewed. TLC is considered a promising technique for the separation and semiquantitative analysis of organic compounds, including petroleum products and polycyclic aromatic hydrocarbons, and inorganic substances.

C-0559-77
INFRARED ANALYSIS OF MICRO AMOUNTS OF OIL IN WATER [in Chinese]
Tsai, M.-H. 1976.
T'ai-wan Huan Ching Wei Sheng 8(1):22-29.

Chemical analysis, *Infrared analysis, Detection, *Oil-in-water

Various types of oils and fatty acids were detected in water by infrared analysis at concentrations as low as 0.5 ppm or less. The technique involved mixing the oil-containing sample with NaCl, extracting with CCl_4, and analyzing the CCl_4 extracts.

[from Chemical Abstracts 86(2):#8377s. 1977]

C-0560-77
ALIPHATIC HYDROCARBONS IN SEDIMENTS OF LAKE WASHINGTON
Wakeham, S. G., and R. Carpenter. 1976.
Limnology and Oceanography 21(5):711-723.

Chemical analysis, Chromatography, Sources, Hydrocarbons, Sediments, Detection, Lakes, Washington

Aliphatic hydrocarbons of Lake Washington sediments were detected and characterized by gas chromatography and radiocarbon and stable C isotope analyses. Detailed analyses of cores show increases in petroleum hydrocarbon levels after 1880, which correspond to the start of a period of growth for the adjacent metropolitan area.

[from Chemical Abstracts 86(4):#21654g. 1977]

C-0561-77
HYDROCARBON IN SEWAGE AND URBAN RUNOFF-DELAWARE ESTUARY
Whipple, W., Jr., J. V. Hunter, and S. H. Yu. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 50-55. Proceedings of the Symposium, American University, Washington, D.C., 9-11 August 1976.

Chemical analysis, Source identification, Hydrocarbons, Wastewaters, Refineries, *Sewage, *Urban runoff, Regulations, Delaware

Analyses conducted to identify and measure the sources of petroleum pollutants in the Delaware Estuary indicate that industrial wastes, particularly refinery process effluents, constitute the greatest input, followed by sewage plant effluents and urban runoff. Stringent new regulations are drastically reducing the refinery outputs of hydrocarbons, but such standards are not yet required for controlling municipal treatment plant and urban and industrial runoff inputs.

C-0562-77
HYDROCARBONS IN WATERS. IDENTIFICATION AND MEASUREMENT OF HYDROCARBONS AND THEIR DERIVATIVES IN WATERS
Whitby, F. J. 1976.
Proceedings of the Analytical Division of the Chemical Society
13(8):247-249.

Hydrocarbons, Chemical analysis

"A review with no references."

[from Chemical Abstracts 86(6):#34039k. 1977]

C-0563-77
WATER SOLUBLE COMPONENTS OF CRUDE OILS, FUEL OILS, AND USED CRANKCASE OILS
Winters, K., and P. L. Parker. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977 p. 579-582. (American Petroleum Institute No. 4284)

Chemical analysis, Chromatography, Spectrometry, Crude oil, Petroleum products, Hydrocarbons, Evaporation, *Water soluble fractions

Combined gas chromatography-mass spectrometry was used to identify and monitor evaporative changes in water soluble fractions present in representative crude oils, Bunker C fuel oil, and used crankcase oils. Identified hydrocarbons included alkyl phenols, anilines, indoles, quinolines, benzothiophenes, aromatic aldehydes and ketones. Alkyl benzenes, indens, and naphthalenes were found to evaporate most rapidly and completely from freshly prepared water soluble fractions, resulting in relative enrichment of alkyl phenols, anilines and indoles.

C-0564-77
QUANTIFICATION OF NAVY OILS IN DETERGENT LADEN WATERS
Yu, T. S. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 169-172. (American Petroleum Institute No. 4284)

Analytical techniques, Spectrometry, Extraction. Solvents, *Detergents, *Oil-in-water

The presence of detergents interferes with the solvent extraction and infrared spectrometry measurement technique for quantifying oil in water. This paper describes a study of an analytical method which utilizes silica gel to remove interfering detergent(s) in the extract, so that infrared spectrometry can be used to quantify the oil in water. Silica gel can remove up to 96.5% of the interference, thus enabling the determination of oil in water in which the ratio of the concentration of detergent to oil is less than 10 to one.

6. SOURCE IDENTIFICATION

C-0565-77
THE COAST GUARD'S FORENSIC OIL IDENTIFICATION SYSTEM
Clow, J. C. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 189-192. (American Petroleum Institute No. 4284)

Source identification, Oil spills, Analytical techniques, Chromatography, Spectroscopy, Sampling, USCG

The U.S. Coast Guard Research and Development Center has established the capability to identify and classify oil spill samples with sufficient accuracy and speed so that the results can withstand judicial review, and corrective or administrative action can be directed at the suspected polluter. Five promising techniques were evaluated; of these infrared and fluorescence spectroscopy, and gas and thin-layer chromatography have been selected for development as laboratory and field identification systems.

C-0566-77
SOURCES OF POLYCYCLIC AROMATIC HYDROCARBONS IN THE AQUATIC ENVIRONMENT
Hites, R. A. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 325-332. Proceedings of the Symposium, American University, Washington, D.C., 9-11 August 1976.

Source identification, PAH, Oil spills, Incineration, Chemical analysis

The major sources of polycyclic aromatic hydrocarbons (PCAH) in nature are biosynthesis, petroleum spillage, and combustion from mobile and stationary sources including industrial activity, forest fires and refuse burning. Very complex PCAH mixtures have been identified in recent field and laboratory studies. The present study rules out biosynthesis as a major source and indicates that anthropogenic sources followed by *in situ* modification of the PCAH distribution is a valid hypothesis.

C-0567-77
OIL "FINGERPRINTS" FOR IDENTIFYING POLLUTERS, SYSTEMS FOR CONTROLLING SPILLS
Roberts, W. F. 1976.
Marine Engineering/Log 81(6):30-33.

Source identification, Oil spills, Analytical techniques, Oil transport, Pollution prevention, USCG

USCG is currently testing double-beam fluorescence spectrophotometry as a method of identifying and proving an oil spill's source. Results of tests of this method and others are compared, and pollution prevention techniques during marine oil transport and handling are discussed.

[from Environment Abstracts 6(11):#76-07430. 1976]

C-0568-77
SOURCE AND DISTRIBUTION OF HYDROCARBONS IN SURFACE WATERS OF THE SARGASSO SEA
Wade, T. L., J. G. Quinn, W. T. Lee, and C. W. Brown. 1976.
Sources Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 270-286.
Proceedings of the Symposium, American University, Washington, D.C., 9-11 August 1976.

Source identification, Hydrocarbons, Chemical analysis, Chromatography, Spectrometry, Distribution, Sargasso Sea

The hydrocarbon contents of pelagic tar and surface water samples from the Sargasso Sea were determined by gas liquid chromatography and infrared spectrometry. Small particles (0.3 μm to 1.0 mm diameter) of weathered tar appear to be the major source of cycloparaffins and other hydrocarbons present. The study indicates that previous estimates of pelagic tar may be very low because they did not include the smaller size range of these particles.

B. OIL POLLUTION PREVENTION AND CONTROL

1. CONTAINMENT

C-0569-77
A RIGID, PERFORATED PLATE OIL BOOM FOR HIGH CURRENTS
Ayers, R. R. 1976.
EPA-600/2-76-263, 68-03-0331. 131p.

Containment, Oil spills, Booms, Design and engineering, *High currents

"A radically different rigid, modular boom has been designed and verified by test for permanent installation in high currents. The design is based upon placing a baffle immediately upstream of a barrier to slow down the surface flow and, as a consequence, contain oil between at higher currents than conventional booms."

C-0570-77
AN OIL AND SORBENT MIXTURE CONTAINMENT BOOM
Der, J. J. 1976.
U.S. Patent Application AD-D003 061/0

Containment, Booms, Oil slicks, Design and engineering, Patent

A containment boom for containing a mixture of oil and sorbent floating on water is described.

[from Government Reports Announcements 77(1):#PAT-APPL-767 746/GA. 1977]

C-0571-77
OIL BARRIER WHICH CAN BE ROLLED UP
Dubois, B. J. 1976.
German Patent 2,253,084

Containment, Oil spills, Booms, Design and engineering, Patent

An oil barrier consists of a vertical, inflatable, floating, flexible skirt which is equipped with damping and stabilizing means and defines spaces which are closed on top and open on bottom so that they contain an air cushion. The cushion is subdivided into chambers by vertical walls extending downward to or below the water line. These walls have an elasticity which pushes them away from the other walls, thus automatically opening the air cushions.

[from Petroleum Abstracts 17(3):#229,165. 1977]

C-0572-77
USE OF FLOATING DEFLECTORS FOR OIL SPILL CONTROL IN FAST FLOWING WATERS
Eryuzlu, N. E., and R. Hausser. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 335-340. (American Petroleum Institute No. 4284)

Containment, Oil spills, Rivers, Design and engineering, *Hydrofoil deflectors

A system to control an oil spill in fast moving waters is described. A series of deflectors and hydrofoils deflect the oil from where the spill takes place into a portion of the river where slower currents allow the oil to be collected by conventional means.

C-0573-77
HYDRODYNAMICS OF A DIVERSIONARY BOOM
McCracken, W. E., and F. J. Freestone. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 329-334. (American Petroleum Institute No. 4284)

Containment, Oil spills, Booms, Design and engineering, EPA, *OHMSETT

A U.S. Environmental Protection Agency sponsored test program at their OHMSETT center to study the near-field hydrodynamics of a diversionary boom is reported. Three dimensional flow fields were examined using dye and oil droplets with an underwater video system. Turbulence intensity was measured with a single axis, hot-film anemometry probe.

C-0574-77
SOME OBSERVATIONS OF OIL SLICK CONTAINMENT BY SIMULATED ICE RIDGE KEELS
Moir, J. R., and Y. L. Lau. 1975.
Canada Centre for Inland Waters, unpublished report. 14p.

Containment, Oil slicks, Booms, Beaufort Sea, *Ice ridge keel

Brief, exploratory tests were conducted to compare the capability of an ice ridge keel for retaining oil and that of a boom in open water flow conditions. The two oil containment situations are found to be similar; however, slicks contained behind the sloping ridges are prone to long-term leakage. The presence of an ice-sheet upstream of the barrier does not significantly alter the slick profile or the maximum volume of oil containable in comparison to the open water case.

C-0575-77
EVALUATION OF OIL SPILL BARRIERS AND DEPLOYMENT TECHNIQUES FOR THE ST. CLAIR-DETROIT RIVER SYSTEM
Vanderkooy, N., A. Robertson, and C. J. Beckett. 1976.
Environment Canada, Environmental Protection Service. Technology Development Report EPS-4-EC-76-4. 97p. + viii.

Containment, Oil spills, Booms, Rivers, Contingency planning, Canada, U.S., *Detroit-St. Clair river system

Discussed is the Joint Canada-United States Marine Pollution Contingency Plan, "Operation Preparedness", established to develop operational procedures for dealing with spill incidents in the Detroit-St. Clair river system and to formulate an Action Plan. The performance of 12 oil spill barriers is evaluated and effective deployment procedures are developed.

C-0576-77
CONTAINMENT AND RIDDANCE OF OIL SPILLS
Zall, D. M. 1976.
U.S. Patent 3,977,969

Containment, Oil spills, Coagulation, Patent, *Polymers

The surface of the oil spill is chemically treated with a polymer of high molecular weight and with jelling properties, causing the oil to coagulate. The oil then is raked off the surface of the water. Polyethylene oxide (Polyox) and polyacrylamide are examples of effective polymers.

[from Petroleum Abstracts 17(2):#228,063. 1977]

2. CLEANUP AND RECOVERY

C-0577-77
58' SKIMMER SAVES LOST OIL FOR MORE USEFUL PURPOSES
Anon. 1976.
National Fisherman 57(7):17-8, 29-8.

Oil spills, Skimmers, Recovery, Design and engineering, *MARCO Clean Sounder, Puget Sound

A new oil skimmer vessel called "Clean Sounder" has recently been built by MARCO of Seattle, Washington, and is presently in service in the coastal and inland waters of Puget Sound. The unit uses oil attraction belts to pick up the oil from water; the recovered oil is then squeezed from the belts and stored aboard the skimmer. The vessel has a recovery capacity of 2270 l (600 gal) per minute and handles any type of crude oil, refined oil and floating debris.

C-0578-77
CLEAN SWEEP OIL RECOVERY SYSTEM: PONTOON MODEL R2003 SPECIFICATION NO. 55183/4 (product information)
Anon. n.d.
Lockheed Missiles and Space Co., Sunnyvale, California. 11p.

Oil spills, Recovery, Harbors, Design and engineering, *Clean Sweep

An oil recovery system designed for calm seas and harbors is described. The unit is mounted on four pontoon hulls, one of which contains a built in sump and storage tank. Maximum oil discharge rate is 1100 l/min (300 gal/min) with a full power endurance of 8 hours.

[from Oceanic Abstracts 13(6):#76-05577. 1976]

C-0579-77
CLEAN SWEEP OIL RECOVERY SYSTEM: HARBOR RAFT MODEL R2003 SPECIFICATION NO. 5518361 (product information)
Anon. n.d.
Lockheed Missiles and Space Co., Sunnyvale, California. 10p.

Oil spills, Recovery, Harbors, Estuaries, Design and engineering, *Clean Sweep

A pontoon mounted oil recovery system designed for harbors, bays, and estuaries is described. Maximum oil discharge rate is 1300 l/min; each pontoon hull contains a storage tank for recovered oil.

[from Oceanic Abstracts 13(6):#76-05578. 1976]

C-0580-77
CLEANUP SYSTEMS INADEQUATE FOR OPEN OCEAN OIL SPILL (news brief)
Anon. 1977.
Sea Technology 18(1):45-46.

Cleanup, Oil spills, Skimmers, USCG, Argo Merchant spill

The "Argo Merchant" oil spill is briefly discussed and U.S. Coast Guard action to prevent oil spillage is reviewed. The U.S. Coast Guard's Clean Sweep oil skimmer is also described.

C-0581-77
ITALIAN OIL SKIMMER AND FIRE FIGHTING CRAFT
Anon. 1976.
Northern Offshore 5(10):43,46.

Skimmers, Oil spills, Monitoring, Cleanup, Mediterranean Sea

The oil skimming vessel "Gaima", which is also useful as fire-fighting craft, personnel carrier and pollution monitoring craft, is described. The vessel has recently been put into service in the Mediterranean Sea.

[from Petroleum Abstracts 17(1):#228,669. 1977]

C-0582-77
OIL SLICK REMOVAL SYSTEM, SKIMJET (product information)
Anon. 1976.
Mechanical Engineering 98(9):62.

Oil slicks, Recovery, Skimmers, Oil-water separation

This water jet system is able to remove 98% of an oil slick measuring 500 m^2 with a thickness of 2 cm each hour from sea or inland water. Various models of the Skimjet, developed and manufactured by Skimovex B.V. of The Hague, are available for work in ports and inland streams as well as in cooling and rinsing water tanks, oil-water separators, refineries, and chemical and meat processing plants.

C-0583-77
SPILL FUND BASED ON PREMIUM PAYMENTS (news brief)
Anon. 1977.
Offshore 37(3):174.

Oil spills, Cleanup, Economics, Tankers, Pipelines, Alaska, *Oil spill fund

The Alaskan Department of Environmental Conservation's efforts to establish a $30 million fund for the cleanup of oil spills in state waters are discussed and contrasted with the federal Trans-Alaska Pipeline Liability Fund. The state fund will be derived from owners of tankers and oil terminals who will pay a premium based on the state's analysis of their risk.

C-0584-77
SOCK - AN OIL SKIMMING KIT FOR VESSELS OF CONVENIENCE
Ayers, R. R., and A. V. Barnett. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 361-366. (American Petroleum Institute No. 4284)

Oil spills, Cleanup, Skimmers, Containment, Design and engineering, Cost analysis, Gulf of Alaska

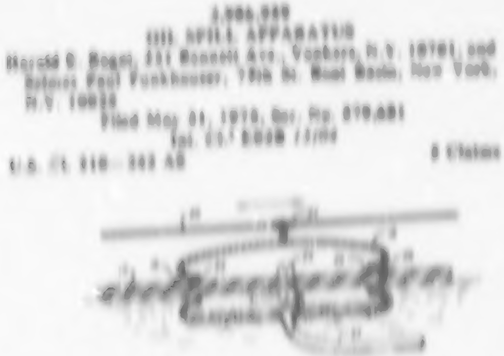
The design and specifications of the Spilled Oil Containment Kit (SOCK), an oil spill sweep skimmer for use in the Gulf of Alaska, are described. A cost analysis based on using vessels of convenience rather than a specific skimmer vessel is presented.

C-0585-77
OIL SPILL APPARATUS
Bagot, H. E., and S. P. Funkhouser. 1976.
U.S. Patent 3,986,959

Cleanup, Recovery, Oil spills, Patent, Design and engineering, *Oleophilic sponge

An endless belt apparatus which utilizes oleophilic and hydrophobic sponge or mop has been designed for the removal of floating oil. The apparatus contains the means to squeeze out recovered oil and to draw or pump the oil into a storage tank.

[from Petroleum Abstracts 17(1):#229,366. 1977]



C-0586-77
ROLE OF THE MUSSEL IN PURIFYING SEA WATER OF PETROLEUM PRODUCTS (IN EXPERIMENT) [In Russian]
Rioko, E. V., and Yu. M. Petrov. 1975.
Gidrobiologicheskii Zhurnal 11(2):28-33.

Oil spills, Cleanup, Seawater, Mollusks, Oxidation, *Water purification, *Mussels, **Mytilus edulis*

In aquaria with *M. edulis*, water is purified twice as fast as in the control (without animals). About 7% of the initial amount of petroleum product remains three weeks after mussels are introduced into aquaria; 1.4% of these products is settled by hydrobionts onto the bottom of the vessels; 5.6% remains in the surface film; and about 0.2% is dissolved in the water. Chemical oxidation of oil is assumed to begin three weeks after its introduction.

[From Selected Water Resources Abstracts 10(1):#W77-00418. 1977]

C-0587-77
NEW CONCEPT OF OIL DISPERSION IN VIEW OF CLEANUP BY DEGRADATION
Bocard, C., B. Durif-Varambon, C. Gatellier, Ph. Renault, P. Laboureur, and L. Person. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 407-410. (American Petroleum Institute No. 4284)

Oil spills, Dispersants, Cleanup, Toxicity, Biodegradation

Results of this study suggest that a complete degradation of crude oil can be assured by use of a new generation of dispersants which could be called "degrading detergents". Treatment using the degrading detergents would maintain the polluting hydrocarbons near the surface of the ocean and in the most reactive part of the water column, containing the planktonic and microbial biomass active in organic carbon decay.

C-0588-77
AN OFFSHORE MECHANIZED SORBENT OIL RECOVERY SYSTEM USING VESSELS OF OPPORTUNITY
Brunner, D. E., J. J. Der, and D. Hall. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 251-254. (American Petroleum Institute No. 4284)

Oil spills, Recovery, Absorption, Design and engineering

The development of an experimental prototype offshore oil recovery system designed for use on vessels of opportunity by the Civil Engineering Laboratory is described and the results of tests at sea are reported.

C-0589-77

SOME RECENT OBSERVATIONS REGARDING THE UNIQUE CHARACTERISTICS AND EFFECTIVENESS OF SELF-MIX CHEMICAL DISPERSANTS

Canevari, G. P. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 387-390. (American Petroleum Institute No. 4284)

Dispersants, Chemical analysis, Oil spills, *Dilution rate

The use and effectiveness of self-mix chemical dispersants in minimizing damage from oil spills are discussed, and laboratory results of bioassays performed with one micron diameter oil droplets are reported. Data to support the theory that droplet size influences the dilution rate of spilled oil are presented.

C-0590-77

DEVICE FOR RECOVERING OILY POLLUTING LIQUID FROM A WATER SURFACE

Degobert, P., F. Kermarrec, and Y. Madaud. 1976.
British Patent 1,439,670

Oil slicks, Recovery, Design and engineering, Patent *Oleophilic container

An apparatus for removing oil slicks consists of a floating container having a porous oleophilic membrane and an impermeable collection sump which holds oil that has trickled through the oleophilic membrane. The device can be heated to reduce the viscosity of thick oils, thus aiding their penetration into the interior.

[from Chemical Abstracts 86(4):#21701v. 1977]

C-0591-77

EFFECTIVELY RECOVERING OIL SPILLS TO GROUNDWATER

Dennis, D. M. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 255-258. (American Petroleum Institute No. 4284)

Oil spills, Recovery, Hydrocarbons, Groundwater, Contingency planning, Cost analysis

Oil spills on land pose a threat to potable water supplies through hydrocarbon contamination of groundwater. Three oil recovery methods are outlined: the recovery trench method is used when groundwater is less than three meters (10 feet) from the surface; the recovery well method employs a draw-down pump to concentrate the spilled oil; the recovery crock method is used as a barrier in areas of little groundwater movement. A cost analysis and a contingency plan outline are given for these methods.

C-0592-77

APPARATUS FOR COLLECTING OIL SLICKS FROM A BODY OF WATER

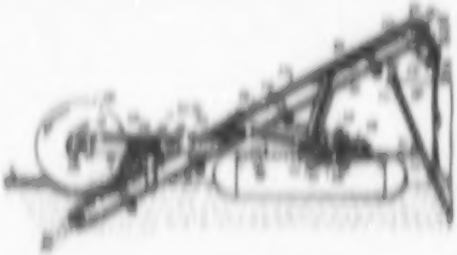
DeVoss, E. A. 1976.
U.S. Patent 3,968,041

Oil slicks, Recovery, Skimmers, Design and engineering, Patent

A system for removing oil slicks from water surfaces is described and various features of the device are treated in detail.

[From Petroleum Abstracts 16(42):#226,004. 1976]

3,968,041
APPARATUS FOR COLLECTING OIL SLICK FROM A BODY OF WATER
Edwin A. De Voss, [illegible] Vista, Calif. [illegible]
Continuation-in-part of Ser. No. [illegible], March [illegible], 1971, abandoned. This application Sept. [illegible], 1973, Ser. No. [illegible]
Int. Cl.² [illegible]
U.S. Cl. 210—242 S 10 Claims



C-0593-77

NOVEL DISPERSING NITROGEN COMPOUNDS USABLE IN CLEANING HYDROCARBON IMPURITIES BY BIODEGRADATION

Durif-Varambon, B., C. Bocard, C. Gatellier, and B. Sillion. 1976.
French Patent 2,295,786

Dispersants, Hydrocarbons, Oil slicks, Cleanup, Biodegradation, Patent, *Nitrogen compounds

The chemical and biological degradation of hydrocarbons on and in water is effected by use of biodegradable nitrogen-based dispersants obtained by the cyanoethylation of oxyalkylated alcohols followed by reduction.

[From Petroleum Abstracts 16(50):#227,852. 1976]

C-0594-77
NOVEL DISPERSING BIODEGRADABLE NITROGEN COMPOUNDS USED IN CLEANING UP HYDROCARBON IMPURITIES
Durif-Varambon, B., C. Gatellier, C. Bocard, and B. Sillion. 1976.
French Patent 2,295,787

Dispersants, Hydrocarbons, Oil slicks, Cleanup, Biodegradation, Patent, *Nitrogen compounds

Hydrocarbons on and in water can be dispersed with biodegradable nitrogen compounds obtained by acylation of aliphatic amines with hydroxylated acids or their lactones. This process assures catalytic oxyalkylation so that a suitable hydrophilic-lipophilic equilibrium results.

[from Petroleum Abstracts 16(50):#227,853. 1976]

C-0595-77
NOVEL DISPERSING NITROGEN COMPOUNDS FOR THE BIODEGRADATION OF HYDROCARBON IMPURITIES
Durif-Varambon, B., C. Bocard, C. Gatellier, and B. Sillion. 1976.
French Patent 2,295,788

Dispersants, Hydrocarbons, Oil slicks, Cleanup, Biodegradation, Patent, *Nitrogen compounds

Hydrocarbon pollutants on and in water can be dispersed with nitrogen compounds obtained by combining glutamic acid with a hydroxylated compound and an alkylene oxide.

[from Petroleum Abstracts 16(50):#227,854. 1976]

C-0596-77
SKIMMING SAUCER
Falsa, H. 1976.
Canadian Patent 998,625

Skimmers, Oil slicks, Recovery, Design and engineering, Patent

A saucer-shaped oil skimming apparatus is described in which an open oil collection container is designed to float with its rim just below the oil-water interface. The device is most suitable for still water surfaces such as refinery effluent ponds.

[from Petroleum Abstracts 17(1):#228,670. 1977]

C-0597-77
UTILIZATION OF DISPERSANTS IN OFFSHORE AREAS
Fitzgerald, D. E. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 396-398. (American Petroleum Institute No. 4284)

Dispersants, Oil spills, Cleanup, Environmental effects, Contingency planning, API

The use of low toxicity oil dispersants that threaten sensitive environmental or commercial areas is discussed and the role of the On-Scene Coordinator (OSC) in dispensing dispersants is presented. Revisions to the National Contingency Plan are offered by the American Petroleum Institute Task Force.

C-0598-77
DEVELOPMENT OF A HIGH CURRENT STREAMLINED OIL BOOM/SKIMMER FOR INLAND WATERWAYS
Folsom, B. A., and C. Johnson. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 323-327. (American Petroleum Institute No. 4284)

Oil spills, Recovery, Booms, Skimmers, Oil-water separation, Design and engineering, *OHMSETT

A streamlined oil boom/skimmer is described which uses a slightly submerged slotted hydrofoil to skim a thin layer of oil and water into an attached sump where the oil and water are separated and the oil retained. Sump design, stable control/flotation system, and tests at OHMSETT are reported.

C-0599-77
THE STORY OF A SUCCESSFUL OIL SPILL COOPERATIVE: THE CORPUS CHRISTI AREA OIL SPILL CONTROL ASSOCIATION
Franklin, H. L. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 65-68. (American Petroleum Institute No. 4284)

Oil spills, Cleanup, Pollution control, Economics, Texas, *Corpus Christi

The history of the Corpus Christi Area Oil Spill Control Association, a nonprofit Texas corporation, is reviewed and two reasons for its success are given. The first is the equal share taken by industry, federal, state, and local governments to finance the budget and the second is the low average cleanup cost per gallon.

C-0600-77
PERFORMANCE TESTS OF THREE FAST CURRENT OIL RECOVERY DEVICES
Getman, J. H. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 341-346. (American Petroleum Institute No. 4284)

Oil spills, Recovery, Skimmers, Design and engineering, USCG

THE U.S. Coast Guard development program to evaluate seven different small-scale, fast-current recovery devices is reviewed. The results of tests on two full scale models at the OHMSETT center are reported.

C-0601-77
DISPERSANT FIELD TRIALS IN CANADIAN WATERS
Gill, S. D. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 391-394. (American Petroleum Institute No. 4284)

Oil spills, Cleanup, Dispersants, Canada, *Canadian Coast Guard

Field trials conducted by the Canadian Coast Guard Marine Emergency Organization on a number of commercial oil dispersants using the Warren Springs type of testing apparatus are reported and the effectiveness of dispersants in both warm and cold waters is discussed.

C-0602-77
FRENCH OIL SPILL POLICY: THE RECOVERY PHASE
Guerin, P., and J. Pichon. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 355-360. (American Petroleum Institute No. 4284)

Oil spills, Recovery, Skimmers, Booms, Storage, France

France emphasizes recovery of oil rather than chemical dispersion. Containment, recovery, and storage equipment are reviewed and details concerning booms, skimmers, and storage containers used in France are given.

C-0603-77
A MODEL FOR THE COSTING OF OIL SPILL CLEARANCE OPERATIONS AT SEA
Holmes, P. D. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 39-44. (American Petroleum Institute No. 4284)

Oil spills, Models, Cleanup, Recovery, Cost analysis

The model used in this study has been useful in identifying the main component costs for different techniques of cleaning up oil spills in a variety of situations. This model takes into account the spill size, makes allowance for transport time, and allows for the practical effects of natural dispersion, evaporation, etc. Dispersant application is probably the most cost-effective method of oil spill treatment for oil spills below about 2,000 tons. For spilln larger than this size, calculations show an economic advantage for the use of mechanical recovery methods.

C-0604-77
A DISCUSSION OF THE RESTORATION OF AN OIL SPILL AT MAYTON
Loader, J. G. 1975.
Conference on the Environmental Effects of Oil and Salt Water Spills on Laud, Banff, Alberta, 1975. Alberta Environment, and University of Calgary, 1975. p. 240-249.

Restoration, Oil spills, Cleanup, Canada, *Mayton oil spill

The cleanup techniques employed by Hudson's Bay Oil and Gas Co. Ltd. at the Mayton oil spill are discussed and restoration methods used on the oiled farm land are presented.

C-0605-77
PROCESS FOR TREATING FRESH WATERS AND SEA WATERS POLLUTED BY HYDROCARBONS
Marconi, W., N. Oddo, and L. Degen. 1976.
Belgian Patent 813,617

Hydrocarbons, Cleanup, Oil spills, Biodegradation, Bacteria, Patent

Lipophilic compounds of nitrogen and phosphorus salts are treated with paraffin to aid in flotation. These salts are usable by bacteria which metabolize the hydrocarbons on the sea surface.

[From Petroleum Abstracts 17(6):#230,143. 1977]

C-0606-77
CONSIDERATIONS FOR FIELD USE OF DISPERSANTS
McCarthy, L. T., Jr. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 395-401. (American Petroleum Institute No. 4284)

Dispersants, Oil spills, Cleanup, Toxicity, EPA

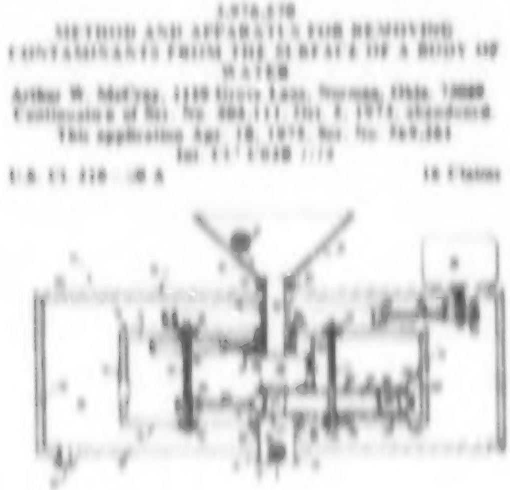
A rationale is presented for the correlation of laboratory generated dispersant data to the spill situation in the field; dispersant toxicity and effectiveness in the water column are discussed. Current Environmental Protection Agency research projects on oil spill dispersants are summarized.

C-0607-77
METHOD AND APPARATUS FOR REMOVING CONTAMINANTS FROM THE SURFACE OF A BODY OF WATER
McCray, A. W. 1976.
U.S. Patent 3,976,570

Oil slicks, Cleanup, Petroleum products, Absorption, Design and engineering, Patent

Oil and petroleum products are removed by a procedure and apparatus which distributes oil absorbent, porous spheres on the water surface. The spheres absorb the oil and are removed; the absorbed oil is then recovered by a centrifuge apparatus, and the oleophilic spheres are returned to the water for further recovery.

[from Petroleum Abstracts 16(50):#227,058. 1976.]



3,976,570
METHOD AND APPARATUS FOR REMOVING
CONTAMINANTS FROM THE SURFACE OF A BODY OF
WATER
Arthur W. McCray, [illegible] Lane, Norman, Okla. [illegible]
Continuation of Ser. No. [illegible], [illegible] 1974, abandoned.
This application Apr. 10, 1975, Ser. No. [illegible]
Int. Cl.² E02B 15/04
U.S. Cl. 210—36 R 10 Claims

C-0608-77
COMBINED SKIMMER-BARRIER HIGH SEAS OIL RECOVERY SYSTEM
Milgram, J. H., and R. A. Griffiths. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 375-379. (American Petroleum Institute No. 4284)

Oil spills, Recovery, Skimmers, Booms, Containment, Design and engineering, USCG

The development and design of an oil recovery system to be used in conjunction with the U.S. Coast Guard's high seas oil containment barriers are described. Tests conducted at the Environmental Protection Agency's OHMSETT facility and at sea are reported.

C-0609-77
DEBRIS HANDLING SYSTEM FOR NAVY HARBOR OIL SPILL CLEANUP OPERATIONS
Nadeau, P. F. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 271-275. (American Petroleum Institute No. 4284)

Oil spills, Cleanup, Skimmers, Harbors, USN, *Debris handling system

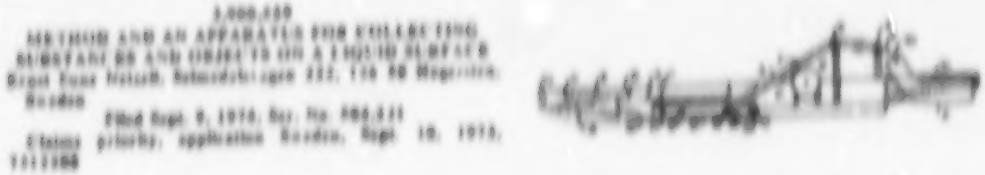
The development of a debris handling system for installation on Navy harbor oil skimmers is traced and specific problems, such as handling oily debris, system operation, and harbor debris, are discussed. The advantages of this system are: the flexibility of the skimmer is enhanced, manpower requirements and labor costs are reduced, the long term cost effectiveness of oil spill cleanup operations is greatly increased, and morale is enhanced by the elimination of manual debris handling operations.

C-0610-77
METHOD AND AN APPARATUS FOR COLLECTING SUBSTANCES AND OBJECTS ON A LIQUID SURFACE
Netzell, E. S. 1976.
U.S. Patent 3,980,559

Oil slicks, Skimmers, Recovery, Patent, Design and engineering

Oil and oily substances floating on water are collected by an apparatus which skims off the contaminant layer and floating objects, distributes these over a comparatively large collecting area, has means for collecting and separating the contaminant material, and drains off the cleaned liquid.

[From Petroleum Abstracts 16(50):#227,059. 1976]



C-0611-77
WHAT CONSTITUTES GOOD TELECOMMUNICATIONS SYSTEMS FOR AN OIL SPILL CLEANUP
Pearce, R. B. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 69-75. (American Petroleum Institute No. 4284)

Oil spills, Cleanup, Pollution control, California, *Oakland estuary, *Telecommunications systems

The foundation of a good telecommunications system for oil spill cleanup consists of two networks: one, an operations system to keep the cleanup team synchronized and two, a logistics system to maintain a flow of support materials and equipment. Appropriate telecommunications equipment are listed and the Oakland estuary is cited as a case example.

C-0612-77
OIL COLLECTION BARGE
Petchul, S. L., and R. K. Petchul. 1976.
U.S. Patent 3,966,615

Oil spills, Recovery, Containment, Design and engineering, Patent, *Collection barge

A barge which collects and then contains and concentrates oil spilled on the surface of water is described; the operation of the vessel over large areas and in adverse sea states is discussed.

[from Petroleum Abstracts 16(42):#226,003. 1976]

C-0613-77
OIL COLLECTOR
Saeki, M., T. Hosono, K. Mizumaki, and T. Honda. 1976.
Japanese Kokai (unexamined patent application) 76 61,796

Waste oil, Cleanup, Absorption, Patent

The oil-absorbent material consists of 40-97 parts powdered wood or grass with less than 30% water, and 3-60 parts material containing humic acid.

[from Chemical Abstracts 86(4):#21698z. 1977]

C-0614-77
DEVELOPMENT OF AN OIL SPILL RECOVERY SYSTEM FOR ARCTIC OPERATIONS
Scharfenstein, C. F., and M. G. Hoard. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 301-307. (American Petroleum Institute No. 4284)

Oil spills, Recovery, Ice, Design and engineering, Arctic, Canada, *Clean Sweep

The results of Canadian and Lockheed tests of the Clean Sweep oil recovery system in ice-clogged arctic waters are presented. The design of the arctic vessel, the ice processor, and plans for use of the system in arctic oil spill control operations are discussed.

C-0615-77
THE APPLICATION OF EXISTING OIL SPILL ABATEMENT EQUIPMENT TO COLD REGIONS
Schultz, L. A., and P. C. Deslauriers. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 309-317. (American Petroleum Institute No. 4284)

Oil spills, Arctic, Recovery, Containment, Remote sensing, Storage, Disposal

A recently completed survey study included a review and cursory evalution of oil spill response techniques and equipment currently used in warmer climates for application in the more severe environmental conditions of the arctic. The survey revealed that while a very limited degree of oil spill response capability presently exists for use in cold regions, a great deal of development work must be undertaken before a total cold regions oil response capability will be available.

C-0616-77
CLEANING THE CARGO TANKS ON PETROLEUM TANKERS USING THE PREPARATION IM-1 [in Russian]
Semanov, G. N. 1975.
Trudy Tsentral'nyi Nauchno-Issledovatel'skii Institut Morskogo Flota No. 203:76-80.

Tankers, Oil tanks, Cleanup, Surfactants

Various preparations for cleaning petroleum tanks were compared. The nontoxic and biodegradable cleaning agent IM-1 removed the greatest amount of petroleum in the shortest amount of time, was the least corrosive agent, and had a greater multiplicity of other uses.

[from Chemical Abstracts 86(2):#6935f. 1977]

C-0617-77
USE OF DISPERSING AGENTS IN ELIMINATION OF THE CONSEQUENCES OF ACCIDENTAL PETROLEUM SPILLS [in Russian]
Semanov, G. N. 1975.
Trudy Tsentral'nyi Nauchno-Issledovatel'skii Institut Morskogo Flota No. 203:67-72.

Oil spills, Cleanup, Dispersants

"A review with 5 references."

[from Chemical Abstracts 85(22):#166294d. 1976]

C-0618-77
A DISTRIBUTED REUSABLE-SORBENT OIL RECOVERY SYSTEM
Shaw, S. H., and J. S. Dorrler. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 247-250. (American Petroleum Institute No. 4284)

Oil spills, Recovery, Absorption, Rivers, Estuaries, Harbors, Design and engineering, EPA, *OHMSETT

The design, fabrication and test of a prototype system for the recovery of spilled oil from the surface of river, estuarine, and harbor waters are described. The tests were conducted at the Environmental Protection Agency's OHMSETT tank using diesel fuel and lubricating oil with efficiencies ranging from 85% to 100%.

C-0619-77
TECHNIQUES FOR MIXING DISPERSANT-TREATED OIL SLICKS INTO THE WATER
Smith, G. F., and W. E. McCracken. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 403-406. (American Petroleum Institute No. 4284)

Oil slicks, Cleanup, Dispersants, Design and engineering, EPA, *OHMSETT

Test results are given of an Environmental Protection Agency sponsored project conducted at their OHMSETT facility to measure the relative effectiveness of four devices for adding mixing energy to an oil slick after dispersant application. The modified five-bar gate proved to be the most effective for breaking up a one mm thick oil slick into droplets with the greatest depth of penetration.

C-0620-77
A FIELD EVALUATION OF OIL SPILL RECOVERY DEVICES
Solsberg, L. B. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 303-307. (American Petroleum Institute No. 4284)

Oil spills, Recovery, Crude oil, Fuel oil, Skimmers, Oil-water separation, Canada

Test conditions and results of 10 classes of commercially available oil skimmers used to clean up bunker, crude, and diesel oils in Canadian coastal harbors are reported and oil-water separation equipment is discussed.

C-0621-77
FIELD EVALUATION OF SEVEN OIL SPILL RECOVERY DEVICES
Solsberg, L. B., C. W. Ross, W. J. Logan, and M. F. Fingas. 1976.
Environment Canada, Environmental Protection Service. Technology Development Report EPS-4-EC-76-3. 81p. + xii.

Oil spills, Recovery, Skimmers, Emulsification, Canada

An evaluation of seven oil spill recovery devices was undertaken by the Centre of Spill Technology of the Environmental Emergency Branch. Evaluation was based on four parameters: oil recovery rate, oil recovery factor, oil content factor, and emulsification factor. The design of each skimmer is discussed and suggestions for improvements are made.

C-0622-77
DISCOVERY, CONTAINMENT AND RECOVERY OF A JET FUEL STORAGE TANK LEAK: A CASE HISTORY
Talts, A., J. Bauer, C. Martin, and R. Reeves. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 259-263. (American Petroleum Institute No. 4284)

Leakage, Gasoline, Oil tank, Recovery, Containment, Groundwater

The containment and recovery of approximately 314,000 l (83,000 gal) of JP-4 fuel lost from an aboveground storage tank at a U.S. government terminal are described. Fuel was found at the water table and about 25% of the lost fuel was recovered. Recommendations for terminal areas with porous soil are given.

C-0623-77
DEVELOPMENT OF OIL SPILL RECOVERY SHIP
Uchida, S., H. Takeshita, and Y. Seiko. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 367-374. (American Petroleum Institute No. 4284)

Oil spills, Recovery, Skimmers, Oil-water separation, Design and engineering

An oil recovery system made up of a special oil suction float, a hydraulic fluid conveying unit, and an oil-water separating unit was developed and installed in a small, self-propelled, twin-hull craft. The experimental oil recovery ship completed in this manner successfully cleaned up a slick of heavy oil, 7m x 30m and 0.7-2.0mm in thickness in less than three minutes at 0.5-1.0 kt. Oil content of the water at the oil-water separation unit was less than one ppm.

C-0624-77
HARBOR OIL SPILL REMOVAL/RECOVERY SYSTEMS: PHASE 2
U.S. Navy. 1976.
Report No. Y41-21-001-01-001. 14p.

Oil spills, Recovery, Containment, Skimmers, Booms, EPA, *OHMSETT

Test procedures for oil containment booms and oil skimmers were developed and validated according to the EPA Oil and Hazardous Materials Simulated Environmental Test Tank (OHMSETT) requirements. The results of these tests are summarized and recommendations are presented.

[From Petroleum Abstracts 17(5):#220,888. 1977]

C-0625-77
OIL COLLECTING DEVICE
West, G. L. 1976.
Canadian Patent 995,593

Oil spills, Recovery, Skimmers, Design and engineering, Patent

A device for recovering oil from the water surface is described and consists of an intake member, a sump, and a storage tank.

[from Petroleum Abstracts 16(44):#226,377. 1976]

C-0626-77
BIOLOGICAL CRITERIA FOR THE SELECTION OF CLEANUP TECHNIQUES IN SALT MARSHES
Westree, B. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 231-235 (American Petroleum Institute No. 4284)

Oil spills, Cleanup, Marshes, Biological effects, Manuals

A training manual for the selection and application of cleanup procedures in marshland situations has been developed by URS Research Company. The manual incorporates biological criteria for selection and application of cleanup techniques. It is designed for use by cleanup personnel in the field.

C-0627-77
SURFACE ENHANCEMENT - BRINGING IT ALL TOGETHER
Wilson, J. E. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 347-354. (American Petroleum Institute No. 4284)

Oil spills, Cleanup, Skimmers, Booms, Surfactants, Absorption, Design and engineering, USN

Two oil spill cleanup methods used by the U.S. Navy are described and test results of each method are reported. The confined area spill, with the skimmer in a stationary mode, employs surface active agents, chip sorbents, and a skimmer/boom system. The open area spill, with a moving skimmer, employs two utility boats, granular sorbents, and oil concentration sweeps.

C-0628-77
OIL-ADSORBING POLYURETHANE FOAM
Yokota, K. 1976.
Japanese Kokai (unexamined patent application) 76 68,699

Adsorption, Contaminants, Patent, *Polyurethane foam

Polyurethane foams made from a mixture of 100 parts polyether and 5-50 parts oleophilic material containing $C_{\geq 8}$ alkyl chain will adsorb up to 10 times as much oil as foams made from polyether alone.

[from Chemical Abstracts 85(22):#166220b. 1976]

C-0629-77
A FLOATING MATTER REMOVING APPARATUS
Inventor unknown. 1976.
British Patent 1,454,967

Skimmers, Oil slicks, Recovery, Design and engineering, Patent

An oil skimming apparatus is described which consists of a floating oil collection chamber equipped with adjustably floating means for controlling the oil inlet under various water surface conditions.

[from Petroleum Abstracts 17(1):#228,671. 1977]

3. RESTORATION

C-0630-77
CLEANING AGENTS FOR OILED WILDLIFE
Berkner, A. B., D. C. Smith, and A. S. Williams. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 411-415. (American Petroleum Institute No. 4284)

Restoration, Wildlife, Oil spills, Solvents, Toxicity, *Detergents

The advantages and limitations of detergents and solvents are discussed with respect to the types of wildlife affected, the types of oil involved, and the available equipment and facilities. Several commercial detergents are ranked in order of their effectiveness and optimal concentrations. Toxicity data are included.

C-0631-77
THE RECLAMATION OF LAND AFFECTED BY OIL FIELD BRINES-TWO CASE HISTORIES
Clark, D. J., and H. F. Thimm. 1975.
Conference on the Environmental Effects of Oil and Salt Water Spills on Land, Banff, Alberta, 1975. Alberta Environment, and University of Calgary, 1975. p. 28-37.

Restoration, Inland, Contamination, Soil, Oil fields, *Brines

Two programs for the reclamation of lands contaminated by oil field brines are reported. Problems dealt with include: salt concentration, calcium to sodium ratio, soil tilth, water movement, and soil fertility.

C-0632-77
RESTORATION OF OIL SPILLS ON FOREST SOILS
Nyborg, M., and W. McGill. 1975.
Conference on the Environmental Effects of Oil and Salt Water Spills on Land, Banff, Alberta, 1975. Alberta Environment, and University of Calgary, 1975. p. 277-290.

Restoration, Oil spills, Soil, Vegetation, *Forests,

Oil spills in low lying "muskegs" kill off the vegetation; re-vegetation is inhibited by waterlogging and crusting of the soil due to containment dikes. Good restoration resulted from nutrient addition for three years and application of several tons of lime per acre.

C-0633-77
RESTORATION OF OIL SPILLS ON AGRICULTURAL SOILS
Rowell, M. J. 1975.
Conference on the Environmental Effects of Oil and Salt Water
Spills on Land, Banff, Alberta, 1975. Alberta Environment, and
University of Calgary, 1975. p. 250-278.

Restoration, Oil spills, Soil, Biodegradation, Plants, Fertilizers

Oil damaged mineral soils were best reclaimed by soil application of fertilizers containing N, P, K, and S. Biodegradation of the oil inhibited plant growth, but growth improved as the rate of oil decomposition declined.

C-0634-77
RECLAMATION OF SALT AND OIL DAMAGED SOILS
White, R. A., and E. deJong. 1975.
Saskatoon, Saskatchewan, Saskatchewan Institute of Pedology,
University of Saskatchewan, Publication No. M27.

Restoration, Soil, Oil spills, Canada

Summary not available.

[from Conference on Environmental Effects of Oil and Salt Water Spills on Land, Banff, Alberta, 1975. Proceedings. p. 37.]

C-0635-77
OILED BIRD CLEANUP - A FORMIDABLE TASK
Worthington, V. 1977.
Conservation News 42(4):2-4.

Restoration, Birds, Oil spills, Cleanup, Solvents, Delaware,
*Olympic Games spill

The attempt to save 270 oiled birds rescued after the Olympic Games oil spill in the Delaware River is presented. Methods for cleaning the waterfowl are outlined and several organic cleaning solvents are discussed.

4. OIL TRANSFER AND TRANSPORT

C-0636-77
REPORT OF THE SYMPOSIUM ON PREVENTION OF MARINE POLLUTION FROM SHIPS
Anon. 1976.
London, Inter-Governmental Maritime Consultative Organization, 1976. 90p.

Oil transport, Ships, Tankers, Pollution prevention, Oil-water seperation, Oil spills

Subjects covered include a review of the 1973 convention; national and regional arrangements; construction, equipment, and operation of chemical tankers; segregated ballast tankers; oily water separators and oil monitoring and control equipment; operation of oil tankers; reception facilities in ports; sewage and garbage from ships; contingency planning; measures for control, detection, and data collection; and methods for dealing with spills.

[from Pollution Abstracts 8(1):#77-00345. 1977]

C-0637-77
TRAGEDY OF TANKER GROUNDING EMPHASIZED
Anon. 1976.
National Fisherman 57(8):17-A.

Oil spills, Tankers, Metula oil spill, Environmental protection, Offshore drilling, Pollution control

The long-lasting adverse effects of the 1974 Metula oil spill, the need for careful environmental planning in offshore drilling, and incidents leading to the evolution of the present oil spill control technology were topics recently discussed at the Second Annual Marine Technology Assessment Conference held at the Texas A & M University.

C-0638-77
CHALLENGE OF DEEPWATER TERMINALS
Bragaw, L. K., H. S. Marcus, G. C. Raffaele, and J. R. Townley. 1975.
Lexington, Mass., D. C. Heath and Co., 1975. 186p.

Offshore development, Ports, Tankers, Socio-economic effects, Environmental effects, *Deepwater terminals

The development of deep-water terminals presents potential hazards that must be considered and dealt with. To aid in formulating policies on offshore ports, this study examines the economic, social, technological, and environmental impacts - both offshore and onshore - of such development.

[from Petroleum Abstracts 16(50):#227,830. 1976]

C-0639-77
OIL IMPORTS AND DEEPWATER PORTS
Brown, D. 1976.
Environmental Data Service Jan:10-13.

Ports, Environmental effects, Socio-economic effects, Oil spills, Coasts, *Deepwater ports

The environmental and socio-economic effects of deepwater ports are dealt with in the Deepwater Port Act of 1974. The delegation of responsibilities to the Deepwater Ports Project Office are reviewed and procedures to evaluate the risk of oil spill damage along coastal waters are presented.

[from Oceanic Abstracts 13(6):#76-05612. 1976]

C-0640-77
WASHINGTON DETERMINED TO CONTROL TANKER MOVEMENT IN PUGET SOUND
Browning, R. J. 1976.
National Fisherman 57(8):16-A.

Tankers, Regulations, Law enforcement, Oil transport, Washington, Puget Sound

Fishermen, environmentalists, and most citizens of the state of Washington approved tough new tanker rules which prohibit the use of oil tankers of more than 125,000 dwt in Puget Sound and also require the use of tugboat escorts. These new regulations have met with considerable resistance from the tanker and oil refinery industry; recent incidents concerning these regulations are detailed.

C-0641-77
POLLUTANT TRANSFER TO THE MARINE ENVIRONMENT
Duce, R. A., P. L. Parker, and C. S. Giam. 1974.
Deliberations and Recommendations of the NSF/IDOE Pollutant Transfer Workshop, Port Aransas, Texas, January 11-12, 1974. 55p.

Hydrocarbons, Oil transfer, Oceans, Distribution, Marine organisms, Food web, *Transfer processes

This report summarizes the research accomplishments during the first two years of the Pollutant Transfer Program of the National Science Foundation, International Decade of Ocean Exploration. Discussion is separated into two chapters: trace metals, and chlorinated and petroleum hydrocarbons. Described are intercalibration and standardization programs planned and underway, research on transfer processes to the marine environment, and transfer processes within the marine environment (physical, chemical, biological) for the three classes of pollutants.

C-0642-77
DEEPWATER PORTS: POLICY ISSUES IN FLORIDA
Dzurik, A. 1976.
Florida Coastal Policy Study: The Impact of Offshore Oil Development. A. L. Pearman and J. W. Stafford (eds.). Florida State University, and University of South Florida, 1975 (reprinted 1976). Chapter VIII. p. 193-222. Final report.

Ports, Oil transfer, Florida, Gulf of Mexico, Environmental effects, Socio-economic effects, Legislation, *Deepwater ports

An overview is presented of the characteristics and policy issues associated with potential construction and operation of deepwater ports in or near Florida waters. Included is an assessment of the environmental, economic, and social impacts of deepwater port development. Pertinent federal legislation and federal and state agencies involved in deepwater port development are identified.

C-0643-77
STRATEGIC PETROLEUM RESERVE. BAYOU CHOCTAW SALT DOME
Federal Energy Administration. 1976.
Draft environmental impact statement, FEA/S-76/346, DES-76-5. 409p.

Crude oil, Storage, Environmental effects, EIS, Louisiana, *Bayou Choctaw Salt Domes

The Bayou Choctaw site, a salt dome with existing cavities located in Iberville Parish, Louisiana, has been selected as a candidate site for the proposed storage of crude oil because it offers the advantage of large storage capacity, easy access to the distribution network, and a short preparation period. This site-specific EIS assesses the environmental impacts caused by site preparation and operation.

[from Government Reports Announcements 76(25):#PB-257 506/6WA. 1976]

C-0644-77
STRATEGIC PETROLEUM RESERVE, COTE BLANCHE MINE
Federal Energy Administration. 1976.
Draft environmental impact statement, FEA/S-76/349, DES-76-7. 691p.

Crude oil, Storage, Environmental effects, EIS, Louisiana, *Cote Blanche Mine

This site specific environmental impact statement assesses the Cote Blanche salt mine located in St. Mary Parish, Louisiana, for the proposed storage of crude oil. The Strategic Petroleum Reserve program was established by Congress to provide the U.S. with sufficient petroleum reserves so as to minimize the effects of any future oil supply interruption.

[from Government Reports Announcements 76(25):#PB-257308/9GA. 1976]

C-0645-77
STRATEGIC PETROLEUM RESERVE, WEEKS ISLAND MINE
Federal Energy Administration. 1976.
Draft environmental impact statement, FEA/S-76/349, DES-76-3.
694p.

Crude oil, Storage, Environmental effects, EIS, Louisiana, *Weeks Island Mine

This site specific environmental impact statement assesses the Weeks Island salt mine located in Iberia Parish, Louisiana, for the proposed storage of crude oil. The Strategic Petroleum Reserve program was established by Congress to provide the U.S. with sufficient petroleum reserves so as to minimize the effects of any future oil supply interruption.

[from Government Reports Announcements 76(25):#PB-257 388/7GA. 1976]

C-0646-77
THE OIL WILL SOON FLOW, BUT WHERE WILL IT GO?
Fradkin, P. L. 1977.
Audubon 79(1):86-111.

Oil transport, Environmental effects, Pipelines, Economic effects, Alaska, California

Transporting Alaskan oil to California and other coastal states is reviewed with particular reference to environmental impacts and citizen opposition. Three pipeline routes, the Sohio, the Northern tier, and the Trans-provincial pipeline, are discussed and economic effects of the oil on west coast industries are presented.

C-0647-77
STUDY ON TREATMENT OF TANKER-DISCHARGED OILY WATER WITH IMPROVED TYPE SLOP TANK
Fukuda, S., Y. Saiko, M. Nakajima, and H. Taniguchi. 1976.
Mitsubishi Heavy Industries Technical Review 13(3):487-495.

Oil discharges, Tankers, Wastewater treatment, *Slop tank

An improved slop tank for oil tanker load-on-top systems is described. The slop tank consists of a sludge recovery compartment and a settling compartment. Tests indicate that the improved load-on-top system satisfies discharge regulations for crude oil established at the 1973 IMCO Convention.

[from Selected Water Resources Abstracts 10(2):#W77-00760. 1977]

C-0648-77
PREVENTION OF POLLUTION DURING OIL TRANSFER OPERATIONS: AN EVALUATION OF USCG PREVENTIVE ACTIONS
Harrald, J. R., C. M. Stone, and K. R. Karwan. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 223-227. (American Petroleum Institute No. 4284)

Oil transfer, Pollution prevention, Oil discharges, Statistical analysis, Regulations, USCG

The origins, implementation, and effectiveness of a U.S. Coast Guard program to prevent discharges of oil during vessel oil-transfer operations are reviewed. An analysis of statistical data indicates that the preventive program and resultant regulations which have been implemented have achieved a measurable reduction of transfer-related pollution incidents.

C-0649-77
ENVIRONMENTAL IMPACTS AND MONITORING OF OIL AND GAS PIPELINES: A TECHNICAL NOTE
Limoges, L. 1975.
Florida Coastal Policy Study: The Impact of Offshore Oil Development. A. L. Pearman and J. W. Stafford (eds.). Florida State University, and University of South Florida, 1975 (reprinted 1976). Chapter VIII. p. 163-191. Final report.

Oil transport, Pipelines, Environmental effects, Estuaries, Plants, Animals, Monitoring, Florida

The potential environmental effects of the construction and operation of oil and gas pipeline corridors in Florida's estuarine and marshland environments are summarized. The tolerance of various plant and animal communities and species to the effects of pipeline dredging, such as sedimentation and water turbidity, are evaluated. Recommendations for monitoring the pipelines are made.

C-0650-77
SUPERTANKERS AND THE LAW OF THE SEA
Mostert, N. 1976.
Sierra Club Bulletin 61(6):13-16.

Tankers, Oil transport, Economics, Oil spills, Pollution control, Regulations, *Standards

The economic plight of the oil tanker owner and its direct effect on increased pollution of the sea by oil spills are discussed. Strong controls are desperately needed for the tanker industry; the best method is for the state from which the tankers sail to impose strong local laws for the tankers using their ports.

[From Energy Review No. 17:10. 1976]

C-0651-77
MINI-COMPUTERS USED IN METERING AND LEAK DETECTION SYSTEMS FOR LIQUID PETROLEUM PRODUCTS PIPELINES
Phillips, R. D., and C. Crider. 1975.
IEEE Petroleum and Chemical Industry Conference, 22nd, Milwaukee, 1975. p. 129-135.

Leakage, Pipelines, Detection, *Mini-computers

The use of mini-computers is discussed on the basis of their advantages, practical limitations and disadvantages; their use by Colonial Pipeline Company in metering and leak detection systems is described and evaluated.

[From The Engineering Index Monthly 14(12):#083245. 1976]

C-0652-77
OIL ON TROUBLED WATERS (editorial)
Plant, A. F. 1977.
Chemical & Engineering News 55(3):4.

Oil spills, Tankers, U.S., Regulations, International agreements

The recent series of tanker accidents off U.S. coasts since December, 1976, is briefly reviewed and the need to establish international and/or national controls on shipping vessels is discussed.

C-0653-77
THE TANKER/PIPELINE CONTROVERSY
Stewart R. J. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 95-99. (American Petroleum Institute No. 4284)

Oil transport, Pipelines, Tankers, Statistical analysis, Oil spills

The paper examines the spill data that have become available in recent years and the analytical techniques applied to the data to see if there is a reasonable basis for the preference given pipelines over tankers. The difficulty encountered in making the pipeline/tanker comparison is illustrated with statistics.

C-0654-77
RECOMMENDED PROCEDURE FOR DEVELOPING DEEP-WATER PORTS DESIGN CRITERIA
U.S. Coast Guard. 1975.
U.S. Department of Transportation, Washington, D.C. 11p.

Development, Ports, Environmental protection, Regulations, Design and engineering

Methods are established for defining the environmental conditions which will affect operations at the port site and which must be considered in establishing design criteria for all fixed marine and floating components of a deep-water port. A list of applicable laws concerning protection of the environment is also included.

[from Petroleum Abstracts 16(48):#227,447. 1976]

C-0655-77
SUPERPORT FOR PALAU DEBATED: ECOPOLITICS IN THE FAR PACIFIC
Walsh, J. 1976.
Science 194(4268):919-921.

Ports, Oil transport, Storage, Social effects, Environmental effects, Oil spills, Pacific Ocean, *Palau, *Superport development

Adverse environmental and social effects which would accompany the development of a superport and oil storage complex in the Palauan Islands are pointed out. Situated near major tanker routes at the western end of the Caroline Islands, the fragile ecology of Palau would be vulnerable to superport construction, dredging, and oil spills, or discharges from tankers and onshore storage facilities.

C-0656-77
NEW THREAT FOR LOUISIANA WETLANDS
Worthington, V. 1977.
Conservation News 42(3):2-5.

Crude oil, Storage, Environmental effects, Oil spills, Groundwater, Vegetation, Louisana, Texas, *Salt domes

The Federal Energy Administration's plan to store imported oil inside five or six salt domes located in southern Louisiana and Texas according to the Energy Policy and Conservation Act of 1974 is detailed. The risks involved in transporting oil and the environmental effects of oil spills and brine spills are discussed with emphasis on groundwater pollution and the destruction of vegetation.

5. WASTE TREATMENT AND DISPOSAL METHODS

C-0657-77
COMPACT INCINERATOR FOR SOLID AND LIQUID WASTES
Anon. 1976.
Processing 22(5):33.

Waste oil disposal, Incineration, Solid wastes, *Liquid wastes

A small self-contained incinerator, the 'Furnapak', is available for applications involving the burning of sewage screening, oily wastes, and sewage sludges. A rotating rabble shaft and air injection are employed in a manner similar to multiple hearth furnaces. Both solid and liquid wastes can be incinerated simultaneously or independently. Operation procedures and capabilities are discussed.

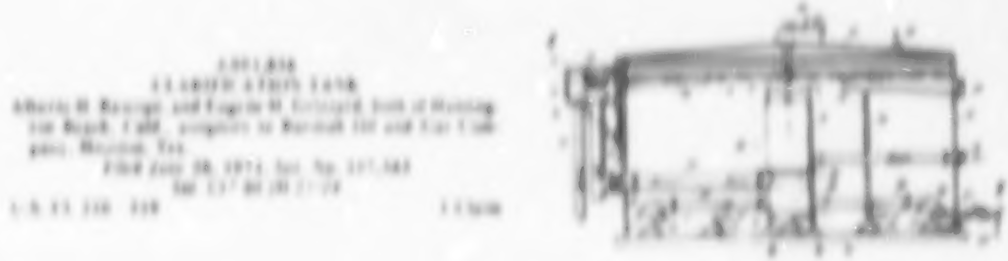
[From Selected Water Resources Abstracts 9(23):W76-12612. 1976]

C-0658-77
CLARIFICATION TANK
Bascope, A. H., and E. H. Grizzard. 1976.
U.S. Patent 3,951,816

Oil-water separation, Design and engineering, Patent

A clarification apparatus and oil-water separation tank designed for the separation of petroleum from flood water are described.

[From Chemical Abstracts 86(4):#18834b. 1977]



C-0659-77
APPARATUS FOR SEPARATING FROM WATER LIQUIDS LIGHTER THAN WATER, ESPECIALLY OIL
Biswanger, K., P. Jakubek, and C. Cuillery. 1976.
Belgian Patent 814,992

Oil-water separation, Design and engineering, Patent

"A valve opening to the air is provided between the pump which moves the liquids and the separation chamber. An overflow is provided in the line between the sedimentation chamber and the filter."

[from Petroleum Abstracts 17(8):#230,638. 1977]

C-0660-77
CONTROLLING SURFACE WATER CONTAMINATION AT THE ESSO REFINERY AT ANTWERP [in Dutch]
Bossuyt, L. 1976.
Het Ingenieursblad 45(2):41-49.

Wastewater treatment, Refineries, Oil-water separation, Belgium

The complex wastewater treatment system at the Esso Petroleum Refinery at Antwerp, Belgium, is described. After various oil-water separation processes, the oil content of the wastewaters is reduced from 30-60 g/m^3 to below 1 g/m^3.

[from Selected Water Resources Abutracts 9(23):#W76-12416. 1976]

C-0661-77
FIGHT AGAINST POLLUTION OF SURFACE WATERS AT THE ESSO REFINERY AT ANTWERP [in French]
Bossuyt, L. 1976.
Technique de l'Eau et de l'Assainissement No. 352:23-34.

Wastewater treatment, Refineries, Pollution prevention, *Surface waters, Belgium

"The prevention of water pollution in oil refineries, waste water treatment installations, and treatment of refinery residues are described."

[from Chemical Abstracts 86(2):#8345n. 1977]

C-0662-77
A SYSTEMS APPROACH TO THE ECONOMICS OF WASTE HANDLING
Bridgwater, A. V., S. A. Gregory, C. J. Mumford, and E. L. Smith. 1975.
Resource Recovery and Conservation 1(1):3-23.

Economics, Oil industry, Wastewaters, Waste oil, Solid wastes, Disposal, Recycling

A systems approach to the economics of treatment, transport, disposal, and recycling of wastes in the oil industry is presented. Costs and benefits of each stage of waste processing and alternative ways of treating, disposing, or recycling specific wastes are considered. The economic effects of new legislation and changes in production and usage patterns are assessed, and alternatives to waste disposal are suggested.

[from Selected Water Resources Abstracts 10(2):#W77-00745. 1977]

C-0663-77
APPARATUS AND METHOD FOR SEPARATING OIL FROM OIL-CONTAMINATED WATER
Broadribb, M. P., P. C. Pitkethly, and M. V. Tideswell. 1976.
German Offenlegungsschriften (unexamined patent application)
2,551,416

Wastewater treatment, Contaminants, Oil-water separation, Coalescence, Design and engineering, Patent

"A column spaced with several layers of solid particles, e.g. anthracite was used for coalescing and separating oil droplets from oil-contaminated waters."

[from Chemical Abstracts 86([illegible]):#8445v. 1977]

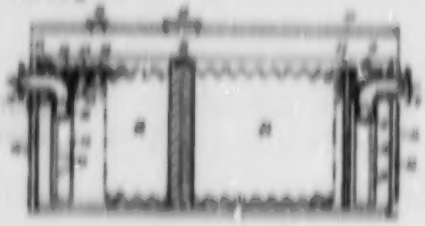
C-0664-77
PLATE SEPARATOR FOR FLUID MIXTURES
Castelli, J. L. 1976.
U.S. Patent 3,957,656

Dispersions, Oil-water separation, Coalescence, Design and engineering, Patent

An oil-water separator is described which is provided with corrugated baffle plates arranged parallel to each other and positioned to provide alternating constriction and expansion during fluid passage. Differential acceleration and deceleration of the dispersed oil droplets enhances collision and coalescence of the droplets.

[from Chemical Abstracts 86(4):#18838q. 1977]

3,957,656
PLATE SEPARATOR FOR FLUID MIXTURES
Joseph L. Castelli, 411 Forest Road, Wayne, Pa. 19087
Continuation of Ser. No. 248,431, April 28, 1972, abandoned.
This application Mar. 4, 1974, Ser. No. 447,788
Int. Cl.² B01D 17/00
U.S. Cl. 210—521 4 Claims



C-0665-77
OIL REMOVAL
Chambers, D. B. 1976.
South African Patent 75 06,346

Emulsions, Oil-water separation, Coalescence, Patent

A method is described for removing oil from an oil-in-water emulsion by contacting the emulsion with a fibrous structure of inorganic fibers and removing the coalesced oil droplets from the fibers.

[from Petroleum Abstracts 17(5):#229,882. 1977]

C-0666-77
SLICK SOLUTIONS TO OILY WATER SEPARATION
Cooke, B. 1976.
Process Engineering October:73-74.

Oil-water separation, Emulsions, Flocculation, Precipitation, Design and engineering

Oil-water separation equipment commonly used to meet various environmental, chemical, and physical requirements is reviewed; emulsions, flocculation, precipitation, oil droplet size, and oil load are discussed.

[from Petroleum Abstracts 17(5):#229,889. 1977]

C-0667-77
NEW TECHNOLOGY IN WATER-HYDROCARBON SEPARATIONS[in French]
Cuillery, C. 1976.
Filtration et Techniques Separatives 7:20-22.

Oil-water separation, Wastewater treatment, Filtration, Flotation

The "Hydropur" process, which utilizes the density differences between water and hydrocarbons to effect oil-water separation, is discussed. The polluted liquid is first filtered to remove suspended particles, then treated by diffusion which allows hydrocarbon particles to float for easy removal.

[from Chemical Abstracts 86(4):#21456u. 1977]

C-0668-77
REDUCTION IN THE VOLUME OF EFFLUENT FROM A REFINERY
Farber, A. L. 1975.
American Institute of Chemical Engineering Symposium Series 71
(151):9-13.

Refineries, Wastewater treatment, Disposal, Conservation

"The different effluent systems, e.g. desalter water, stripped sour water, cooling water blowdown, demineralizer rinse and spent regenerant wastes, and treatment that might be employed in a typical refinery to aid water conservation and reduce the volume are discussed."

[from Chemical Abstracts 86(4):#21497p. 1977]

C-0669-77
PRACTICAL RECOMMENDATIONS FOR OIL SPILL DEBRIS DISPOSAL
Farlow, J. S., D. E. Ross, and R. Landreth. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup),
New Orleans, March 8-10, 1977. p. 265-269. (American Petroleum
Institute No. 4284)

Oil spills, Disposal, Hydrocarbons, Biodegradation, Manuals,
*Debris disposal

A manual and film for oil spill debris disposal prepared by SCS Engineers, Inc., for the Environmental Protection Agency is presented. Because aerobic conditions result in relatively rapid microbial degradation of the hydrocarbons, a landspreading process is recommended wherever debris size and access to suitable land permits.

C-0670-77
BINDER FOR CORROSIVE LIQUIDS ESPECIALLY ACIDS AND OIL
Fuelling, W. 1976.
German Offenlegungsschriften (unexamined patent application)
2,455,316

Oil spills, Cleanup, Waste oil, Absorption, Patent, *Metallurgical
pumice

Spilled acids and oil are absorbed by metallurgical pumice granules that are sintered at 675°C, cooled, and mixed with 5 wt% slaked lime. The mixture sinks into and absorbs crude oil, and the slaked lime improves the oil-pumice bond.

[from Chemical Abstracts 86(4):#21587n. 1977]

C-0671-77
USE OF WATER-SOLUBLE POLYELECTROLYTES FOR PURIFYING PETROLEUM-CONTAINING WASTE WATERS [in Russian]
Gandurina, L. V., L. B. Zubakova, I. N. Myasnikov, L. N. Butseva, A. B. Zhovnirovskaya, and V. V. Ladeneva. 1976.
Plasticheskie Massy No. 5:59-61.

Wastewater treatment, Contaminants, Flocculation, *Flocculant - polyelectrolytes

"Waste waters were purified by cation exchange flocculants, alone or with $Al_2(SO_4)_3$. Flocculant-polyelectrolytes of VPS series, based on vinylpyridine, were used. Combined use of $Al_2(SO_4)_3$ and VPS-47 was the most effective at optimum doses 50g $Al_2(SO_4)_3$ and 2g flocculant/l."

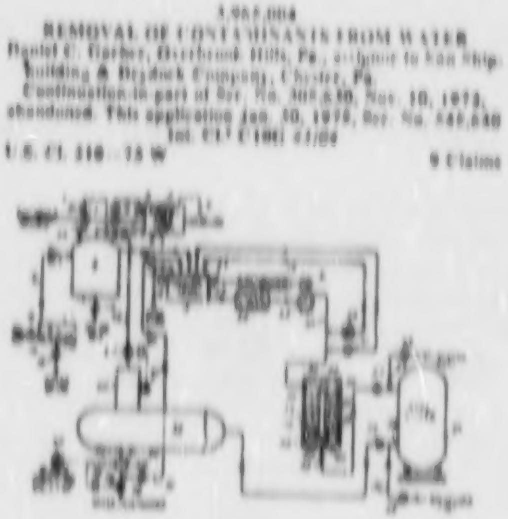
[from Chemical Abstracts 85(24):#181861e. 1976]

C-0672-77
REMOVAL OF CONTAMINANTS FROM WATER
Garber, D. C. 1976.
U.S. Patent 3,965,004

Wastewater treatment, Oil-water separation, Ballast, Coalescence, Patent

Oily ballast water from tankers is treated by passing it through a conventional oil-water separator. The effluent is then passed through a ceramic-pellet dewaxer unit which retains waxes, asphalts, gums and similar materials. Effluent from the dewaxer passes through a sand filter to remove particulates, and a final coalescing unit removes remaining oil droplets.

[from Selected Water Resources Abstracts 10(2):#W77-00687. 1977]



3,965,004
REMOVAL OF CONTAMINANTS FROM WATER
Daniel C. Garber, Overbrook Hills, Pa., assignor to Sun Shipbuilding & Drydock Company, Chester, Pa.
Continuation-in-part of Ser. No. [illegible], Nov. 10, 1972, abandoned. This application Jan. 30, 1975, Ser. No. [illegible]
Int. Cl.² [illegible]
U.S. Cl. 210—[illegible] W 9 Claims

C-0673-77
EFFLUENT REDUCTION THROUGH WATER CONSERVATION AND REUSE AS POLLUTION CONTROL MEASURES FOR PETROLEUM REFINERIES
Goldstein, P. 1976.
American Society of Mechanical Engineers. Petroleum Division, Joint Petroleum Mechanical Engineering and Pressure Vessels and Piping Conference, 1976. Paper 76-Pet-71. 9p.

Wastewater treatment, Refineries, Pollution control, Conservation, *Water reuse

Cooling system effluent reduction by water management, softening, reverse osmosis, and electrodialysis is discussed. Effluent reduction in utilities operations and the overall impact of effluent reduction practices are described and illustrated.

[from Pollution Abstracts 8(1):#77-00410. 1977]

C-0674-77
OPTIMIZE THE EFFLUENT SYSTEM. PART 1. ACTIVATED SLUDGE PROCESS
Grutsch, J. F., and R. C. Mallatt. 1976.
Hydrocarbon Processing 55(3):105-112.

Refineries, Wastewater treatment, Activated sludge, Guidelines

Refinery effluent water quality can be significantly improved and capital and operating costs can be lowered by carefully controlling and integrating the separate elements of a wastewater treatment system. This article, which discusses the activated sludge process, is the first of a series that outlines key objectives and recommends treatment sequences for optimizing refinery wastewater treatment systems.

C-0675-77
OPTIMIZE THE EFFLUENT SYSTEM. PART 2. INTERMEDIATE TREATMENT
Grutsch, J. F., and R. C. Mallatt. 1976.
Hydrocarbon Processing 55(4):213-218.

Wastewater treatment, Refineries, Contaminants, *Intermediate treatment

Intermediate treatment facilities should be optimized for contaminant reduction and equalization using hydraulic, chemical and physical design considerations. This can be achieved by: using a multiple compartmented basin for hydraulic equalization; monitoring for undesirable contaminants using the first compartment; using the second compartment to maximize oxygen transfer and rate of reaction of oxygen with contaminants by using the same highly mixed compartment for pH control; physically removing flocculated contaminants, destabilizing residual colloidal matter chemically and removing it by filtration; and minimizing retention time to conserve heat.

C-0676-77

OPTIMIZE THE EFFLUENT SYSTEM. PART 3. ELECTROCHEMISTRY OF DESTABILIZATION

Grutsch, J. F., and R. C. Mallatt. 1976.
Hydrocarbon Processing 55(5):221-230.

Wastewater treatment, Refineries, *Colloid destabilization

The properties of suspended solids in refinery effluents are described, and the objective of colloidal destabilization of suspended particles by chemical treatment is given. Colloid destabilization mechanisms include: colloid entrapment or removal via sweep floc mechanism, reduction in surface charge by double layer repression, bridging by polymers, and charge neutralization by adsorption. Destabilizing chemicals and a destabilization model are topics discussed.

C-0677-77

OPTIMIZE THE EFFLUENT SYSTEM. PART 4. APPROACH TO CHEMICAL TREATMENT

Grutsch, J. F., and R. C. Mallatt. 1976.
Hydrocarbon Processing 55(6):115-123.

Wastewater treatment, Refineries, *Chemical treatment, *Waterborne colloids

Chemical treatment methods for destabilizing and separating waterborne colloids from refinery wastewaters are detailed. The colloidal components consist of two basic types: the relatively inert substances such as clay, sand, and organics (including oil globules), and microorganisms or biocolloids. Examples and case histories of the treatment of these major colloidal systems are presented.

C-0678-77

OPTIMIZE THE EFFLUENT SYSTEM. PART 5. MULTI-MEDIA FILTERS

Grutsch, J. F., and R. C. Mallatt. 1976.
Hydrocarbon Processing 55(7):113-118.

Wastewater treatment, Refineries, Filtration, Oil-water separation

Theoretical and practical aspects of the filtration of petroleum refinery effluents are examined. Filtration mechanisms and chemical treatments that enhance filtration are briefly discussed. The application of filtration technology by the oil industry in the clarification of make-up waters, API separator effluents, aerated lagoon effluents, activated sludge unit effluents, and treatment of cooling and connate water is described.

C-0679-77
OPTIMIZE THE EFFLUENT SYSTEM. PART 6. BIOCHEMISTRY OF ACTIVATED SLUDGE PROCESS
Grutsch, J. F., and R. C. Mallatt. 1976.
Hydrocarbon Processing 55(8):137-142.

Wastewater treatment, Refineries, Contaminants, Activated sludge, *Biochemistry

The fundamental biochemical principles involved in the biodegradation and removal of organic contaminants from (refinery) wastewaters are reviewed.

C-0680-77
OILY BILGE WATER TREATMENT WITH A TUBULAR ULTRAFILTRATION SYSTEM
Harris, L. R. 1976.
American Society of Chemical Engineers, Aerospace Division, Intersociety Conference on Environmental Systems, 1976. Paper 76-ENAs-20. 6p.

Wastewater treatment, Bilges, Oil-water separation, Filtration, *Tubular ultrafiltration system

A tubular ultrafiltration system using cellulosic and noncellulosic membranes was tested with bilges and other oily wastes, alone and combined with nonionic detergent. Detergent addition resulted in a steeper flux decline than any of the fluids evaluated alone. Both membrane types produced a permeate with an oil content <15 mg/l. The noncellulosic membranes exhibited higher flux rates than the cellulosic membranes; only the former could be restored to its initial water flux by a cleaning operation.

[from Pollution Abstracts 8(1):#77-00236. 1977]

C-0681-77
PROCESS FOR REMOVING DISPERSED MATTER FROM WATER
Irani, C. A., and D. J. McHugh. 1976.
U.S. Patent 3,965,001

Wastewater treatment, Oil-water separation, Adsorption, Precipitation, pH control, Patent

Dispersed matter and oil in water is removed by adding a flocculated salt selected from the group consisting of iron, aluminum and Group IIA of the Periodic Table of Elements, and additional oil. The contaminants are adsorbed by the flocs, and these are precipitated by pH adjustment.

[from Selected Water Resources Abstracts 10(2):#W77-00684. 1977]

C-0682-77
THE LATEST TRENDS IN OILY WASTE WATER TREATMENT [in Japanese]
Katsuta, K. 1976.
Junkatsu 21(4):211-218.

Wastewater treatment, Industries

"A review with 11 references."

[from Chemical Abstracts 85(26):#197553s. 1976]

C-0683-77
OIL ADSORBER
Kobayashi, Y., and T. Onitake. 1976.
Japanese Kokai (unexamined patent application) 76 79,691

Wastewater treatment, Oil-water separation, Adsorption, Patent, *Polyolefin

A polyolefin is mixed with 0.01 to 2.0% nonionic or amphoteric surfactant to yield an oil adsorbing agent.

[from Chemical Abstracts 85(26):#197785u. 1976]

C-0684-77
UPGRADING LOW-GRADE OILS
Kondo, M. 1976.
U.S. Patent 3,959,119

Waste oil, Reclamation, Refining, Patent

A process for refining waste oils and spent oils containing water and sludge is described. The process involves thermal cracking in a fluidized-sand bed at 400-500°C followed by fractionation into gas-liquid phases and condensation to form a refined oil and a combustible gas.

[from Chemical Abstracts 86(4):#19377a. 1977]

C-0685-77
WASTEWATER PURIFICATION IN A PETROCHEMICAL PLANT [in German]
Krause, G. 1975.
Erdoel und Kohle-Erdgas-Petrochemie 28(7):340.

Wastewater treatment, Petrochemicals, Economics, Legislation, West Germany

A brief review of pertinent legislation is presented. The important factors in tightening up the current purification procedures are the new Federal Immission Protection Act; Wastewater Discharge Act, and the 4th Supplementary Law on Water Economy. To comply with current legislation, an average of 8% of total investment costs are used for purification installations.

[from Environmental Health and Pollution Control 10(7):#1597. 1976]

C-0686-77
COALESCING UNIT FOR GRAVITY SEPARATOR
Krueger, D. L. 1976.
U.S. Patent 3,951,814

Wastewater treatment, Oil-water separation, Coalescence, Design and engineering, Patent

A coalescing apparatus and materials are described which remove a dispersed liquid such as petroleum by sorption onto fibers or porous materials.

[from Chemical Abstracts 86(4):#18834k. 1977]

3,951,814
COALESCING UNIT FOR GRAVITY SEPARATOR
Dennis L. Krueger, Hudson, Wis., assignor to Minnesota Mining and Manufacturing Company, St. Paul, Minn.
Continuation of Ser. No. 407,068, Nov. 13, 1973, Pat. No. 3,847,821. This application Nov. 7, 1974, Ser. No. 521,787
The portion of the term of this patent subsequent to Nov. 12, 1991, has been disclaimed.
Int. Cl.² B01D 23/10
U.S. Cl. 210—488 13 Claims

C-0687-77

INTERFACIAL PHENOMENA RELATED TO THE REMOVAL OF EMULSIFIED OIL FROM REFINERY WASTEWATERS

Luthy, R. G., R. E. Selleck, and T. R. Galloway. 1975.
SERL Report 75(3):1-94.

Oil-water separation, Wastewaters, Refineries, Emulsions, Flocculation

API refinery separator effluent levels were reduced to 10 mg/l oil with a 15 mg/l dose of 75% charged diallyldimethylammonium compound copolymer without aluminum or ferric coagulants. Efficient polymer bridging was necessary and good flocculation yielded good oil flotation.

[from Chemical Abstracts 85(26):#197737e. 1976]

C-0688-77

INVESTIGATION INTO THE TREATMENT OF PETROCHEMICAL WASTES

Lyons, B. J., and J. G. Parker. 1975.
Treatment, Recycle and Disposal of Wastes. Clayton, Australia, National Chemical Engineering Conference, 1975. Paper T39-T42.
National Chemical Engineering Conference, 3rd, Victoria, Australia, 1975.

Wastewater treatment, Petrochemicals,

Discussed are the types of treatment processes available to handle petrochemical wastewaters with wide pH fluctuations, high temperatures, variable suspended solids and turbidity, oils and greases, detergents, nutrients, toxic metals, gases and organic matter.

[from The Engineering Index Monthly 14(12):#083249. 1976]

C-0689-77

APPARATUS FOR SEPARATING OIL AND WATER

Maatschappi, B. V. 1976.
Netherlands Application 7,413,907

Wastewater treatment, Oil-water separation, Coalescence, Flotation, Design and engineering, Patent

An oil-water separator is described which consists of a rectangular tank with specially arranged vertical and sloping baffle plates. Flow of oily wastewater through the baffle arrangement causes the oil to coalesce and float to the top of the tank from where it is collected. The oil-free water then exits through an outlet chamber.

[from Chemical Abstracts 86(2):#6648q. 1977]

C-0690-77
SURFACE PHENOMENA IN CHEMICAL ENGINEERING [in Japanese]
Matsumoto, T. 1976.
Hyomen 14(3):165-170.

Wastewater treatment, Oil-water separation, Adsorption, *Detergents

Temperature had a profound effect in experiments in which 1% heavy oil was mixed with seawater at 40-50°. Detergents can inhibit oil-water separation, especially at room temperature. Oil-containing waste water was treated using a settling tank, an oil-water separator, and adsorption on activated carbon.

[from Chemical Abstracts 85(24):#181853d. 1976]

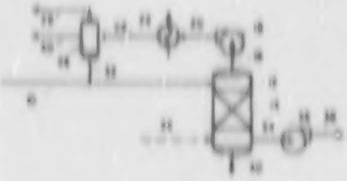
C-0691-77
VACUUM STRIPPING OF HYDROCARBON CONTAMINATED WATER STREAMS
McGill, J. C.
U.S. Patent 3,898,058

Wastewater treatment, Hydrocarbons, Contaminants, *Vacuum stripping

"Use of a high vapor pressure stripping gas on an aqueous stream at at least 40°F."

[from Environmental Technology & Economics No. 1:5. 1977]

3,898,058
VACUUM STRIPPING OF HYDROCARBON
CONTAMINATED WATER STREAMS
James C. McGill, Tulsa, Okla., assignor to H-T Management
Company, Tulsa, Okla.
Filed Apr. 13, 1973, Ser. No. 350,311
Int. Cl. B01d 19/00
U.S. Cl. 55—20 12 Claims



C-0692-77
APPARATUS AND METHOD FOR COAGULATION, FOR USE IN SEPARATING OIL AND WATER
McGrew, J. L. 1976.
German Offenlegungsschriften (unexamined patent application) 2,613,870

Wastewater treatment, Oil-water separation, Emulsion, Coagulation, Patent

An oil-water emulsion is separated in an apparatus having a 3-dimensional network structure with a surface which surbs oils. Oil droplets coagulate on the surface and can be squeezed or washed off the structure.

[from Chemical Abstracts 85(26):#197786v. 1976]

C-0693-77
LIGHT LIQUID AND/OR FAT SEPARATOR
Meier, K. 1976.
German Offenlegungsschriften (unexamined patent application) 2,441,401

Oil-water separation, Wastewater treatment, Design and engineering, Patent

Oils, fats, and other light liquids can be separated from water by a device which contains 2 chambers, connecting channels with slits, and a reflux cleaning device in the separating wall.

[from Chemical Abstracts 86(2):#6641g. 1977]

C-0694-77
PROSPECTS FOR USING MOLLUSK-FILTRATES OF SEA MUSSELS FOR THE PURIFICATION OF BALLAST WATERS OF TANKERS [in Russian]
Milovidova, N. Yu. 1975.
Biologicheskoe Samoochishchenie i Formirovanie Kachestva Vody, Materialy Vsesoyuznogo Simpoziuma po Sanitarnoi Gidrobiologii, 2nd, 1973. M. M. Telitschenko (ed.). Moscow, "Nauka", 1975. p. 141-143.

Wastewater treatment, Ballast, Tankers, Mollusks, **Mytilus galloprovincialis*

When Black Sea mussel, *Mytilus galloprovincialis* was placed in a 200-500 ml vessel containing 0.1% emulsion of crude oil in seawater, the total crude oil content dropped 22-40% in one day in the form of mussel pseudofeces. After 5 days, total content of crude oil decreased by 52% as compared to 26% for the control. Medium size mollusks survived 2-15 days in this environment, while young perished in 8-20 days.

[from Chemical Abstracts 85(24):#181891q. 1976]

C-0695-77
METHOD AND COMPOSITION FOR PURIFYING WASTE WATER
Ochsenschlaeger, M., P. Pfeiffer, and R. Schwiete. 1976.
German Offenlegungsschriften (unexamined patent application)
2,507,733

Wastewater treatment, Waste oil, Emulsions, Patent

A mixture of kaolin and $Al_2(SO_4)_3$, and optionally bentonite and $Fe_2(SO_4)_3$, is used for treating waste water containing emulsified oils such as motor oils and lubricating oils.

[from Chemical Abstracts 86(2):#8452v. 1977]

C-0696-77
PROCESS FOR TREATING EFFLUENTS CONTAINING PETROLEUM PRODUCTS
Oldham, G. F. 1976.
French Patent 2,277,777

Wastewater treatment, Petroleum products, Patent

Wastewater is passed through a sand filter and then through a biological percolation filter. The treated water contains no petroleum products.

[from Petroleum Abstracts 17(6):#230,161. 1977]

C-0697-77
PROCESS AND APPARATUS FOR THE EXTRACTION OF LIGHTER LIQUIDS FROM WATER, ESPECIALLY FROM RESIDUAL WATER
Passavant Werke Miche Hutte. 1976.
French Patent 2,276,237

Wastewater treatment, Extraction, Contaminants, Design and engineering, Patent

This invention provides for the extraction of oil or gasoline from residual water which it pollutes. Feed liquid circulates downward along an inclined passage allowing the buoyancy force to drive the lighter polluting liquid into contact with the roof of the passage and lower side of the baffles. The pollutant is then withdrawn by aspiration or absorption through holes in the top surface of the flow channel.

[from Petroleum Abstracts 17(3):#229,170. 1977]

C-0698-77
PROCESS FOR SEPARATING WATER AND LIGHT HYDROCARBONS FROM A FLUID FLOW MEDIUM
Pilcher, D. W. 1976.
U.S. Patent 3,968,659

Oil wells, Oil-water separation, Design and engineering, Patent

A process for separating petroleum from water at the well head is described. The fluid mixture is conducted through a heat exchanger and a vortex generation chamber splits the fluid flow into a hot and a cold stream. One stream is conducted to the heat exchanger for heat transfer between the stream and the fluid flow, and the cold stream is conducted to a vessel to condense and separate entrained hydrocarbons which are then collected.

[from Chemical Abstracts 86(2):#7029s. 1977]

3,968,659
PROCESS FOR SEPARATING WATER AND LIQUID
HYDROCARBONS FROM A FLUID FLOW MEDIUM
David W. Pilcher, [illegible] Pampa, Tex. [illegible]
Filed Sept. [illegible], 1974, Ser. No. [illegible]
Int. Cl.² [illegible]
U.S. Cl. 62—5 10 Claims

C-0699-77
ENERGY FOR WASTEWATER TREATMENT
Prather, B. V., and E. P. Young. 1976.
Hydrocarbon Processing 55(5):88-92.

Wastewater treatment, Refineries, Water quality, Oil-water separation, *Energy requirements

Energy requirements for petroleum refinery wastewater treatment vary with type of treatment and effluent quality requirements. The major treatment processes are reviewed and energy requirements are given for the API separator, trickling filters, oxidation towers, and activated sludge.

C-0700-77

SEPARATION OF OILS, FATS, AND OTHER FINELY DISPERSED MATERIALS FROM WASTEWATER

Rett, I., T. Peter, G. Jurkovich, and B. Ujfalussy. 1976.
Hungarian Patent 12,027

Wastewater treatment, Oil-water separation, Flutation, Patent

A procedure is described in which wastewater is introduced at high speed into a cylindrical apparatus provided with deflection plates. Air is bubbled upwards along the walls to provide an upward helical motion to the effluent. The combined streaming motion and flotation efficiently separates oil and other substances which are then decanter from the top.

[from Chemical Abstracts 86(4):#21586k. 1977]

C-0701-77

NAVY DEVELOPMENT OF SUITABLE SHIPBOARD BILGE OIL/WATER SEPARATORS

Smookler, A. L., J. W. Harden, and P. D. Conroy. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 423-426. (American Petroleum Institute No. 4284)

Oil-water separation, Bilges, Ships, Design and engineering, USN

The development and evaluation of a Navy shipboard bilge oil-water separator are detailed and performance goals for effluent oil levels during in-port and at-sea periods are established. Test results on actual and deliberately contaminated bilge water are reported.

C-0702-77

OIL-ABSORBING COMPOSITE

Suzuki, T., T. Ito, and T. Onuma. 1976.
Japanese Kokai (unexamined patent application) 76 92,791

Wastewater treatment, Oil-water separation, Absurption, Patent

Micro-cellulosic fiber and micro-inorganic powder are mixed to give an oil-absorbing composite containing less than 20% water. Under experimental conditions, a composition of cellulose pulp and clay absorbed type A heavy oil.

[from Chemical Abstracts 85(24):#179312h. 1976]

C-0703-77
OIL ADSORBENT
Toyama, M., T. Ito, E. Kobayashi, and K. Hino. 1976.
Japanese Kokai (unexamined patent application) 76 100,981

Waste oil treatment, Adsorption, Patent

"Cellophane flakes treated with 1:1 masticated natural rubber-polyterpene resin (softening point 100°) were used as adsorbents for hydrocarbon oils."

[from Chemical Abstracts 86(4):#21586m. 1977]

C-0704-77
CONSOLIDATED HAZARDOUS ITEM LIST
U.S. Navy. Supply Systems Command. 1976.
NAVSUP Publication 4500.

Disposal, Waste oil, Petrochemicals, Storage, Manuals, USN

This U.S. Navy Manual covers the marking, storage, and disposal of some 8000 hazardous and toxic materials including oils and some petrochemicals. It is available from the Navy Fleet Material Support Office, Mechanicsburg, Pennsylvania 17055.

[from Industrial Wastes Information Bulletin 7(5):#HMS 7738. 1976]

C-0705-77
BLACK OIL DISPOSAL TECHNIQUES
Wise, H., and P. A. Brunk. 1977
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 277-279. (American Petroleum Institute No. 4284)

Oil spills, Disposal, Incineration, Chesapeake Bay, *Black oil

The burning of 472,000 l (125,000 gal) of contaminated black oil in the Chesapeake Bay is discussed and the use of the brush burner, a fan which forces a high volume of air to sustain a fire hot enough to burn contaminated black oil, is described.

6. RECLAMATION AND REUSE

C-0706-77
WASTE OIL STUDY. REPORT TO CONGRESS
Environmental Protection Agency. 1974. 414p.

Waste oil, Recycling, Reuse, Disposal, Biological effects

The collection of waste oils from industrial operations and automotive services is the weakest link in the waste oil recycling/disposal scheme. Current disposal methods include re-refining, use as a fuel in industrial applications, use in road oils, asphalts, and as a dust palliative, disposal in sanitary landfills, and intentional dumping on land and in water. The U.S. re-refining industry is discussed and results of biological studies are presented.

[from Governments Reports Announcements 76(24):#PB-257 693/2GA. 1976]

C-0707-77
REGENERATION OF WASTE LUBRICANTS
Takaoka, S. 1976.
Japanese Kokai (unexamined patent application) 76 41,706

Waste oil, Lubricating oil, Reclamation, Patent

Treatment of waste lubricating oils with H_2SO_4 and Na_2CO_3 solution in alcohol, followed by settling, removes sludge. Further treatment with activated clay at 80°-100°C, and subsequent filtration results in fully regenerated lubricating oil.

[from Chemical Abstracts 85(22):#163174r. 1976]

C-0708-77
REGENERATION OF WASTE OILS. VI [in Japanese]
Kawase, Y. 1976.
Sekiyu to Sekiyu Kagaku 20(6):82-86.

Waste oil, Reclamation, Crude oil

"A review with 7 references is presented on the clay treatment of the lubricant fraction from crude oil and on synthetic lubricants."

[from Chemical Abstracts 86(4):#19184k. 1977]

C-0709-77
REGENERATION OF WASTE OILS. VII [in Japanese]
Kawase, Y. 1976.
Sekiyu to Sekiyu Kagaku 20(7):100-104.

Waste oil treatment, Reclamation

The occurrence, purification and properties of waste oils are reviewed.

[from Chemical Abstracts 86(4):#19183j. 1977]

7. PERSONNEL TRAINING AND EDUCATION

C-0710-77
THE SPILL TRAINING AND EDUCATION PROGRAM AT TEXAS A & I CORPUS CHRISTI
Gilchrist, R. E. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 135-136. (American Petroleum Institute No. 4284)

Oil spills, Personnel training, Pollution prevention, Cleanup, Contingency planning, Texas

The week-long Spill Training and Education Program at Texas A & I at Corpus Christi enables the student to accomplish the following: recognize the areal exposure to an oil spill, determine the equipment needed to clean up an oil spill, prepare a contingency plan, and recommend the vehicle to carry out the contingency plan. To accomplish these course objectives students are trained in the use of skimmers, booms, and other cleanup equipment and are given classroom instruction in the environmental, legal, and economic aspects of oil spills.

C-0711-77
HIATUSPORT - AN ON-SCENE COORDINATOR ROLE-PLAYING EXERCISE
Kangeter, E. B., III. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 141-143. (American Petroleum Institute No. 4284)

Oil spills, Personnel training, Pollution control, Contingency planning, USCG, *Hiatusport exercise

The "Hiatusport" technique, an exercise used by the U.S. Coast Guard for training on-scene coordinators, is presented and course objectives and management are reviewed.

C-0712-77
CANADIAN APPROACH TO OIL SPILL TRAINING
Kay, G. H. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 137-138. (American Petroleum Institute No 4284)

Oil spills, Personnel training, Pollution control, Cleanup, Contingency planning, Canada

Oil spill training aids produced by the Consortium on Spill Training (COST), a Canadian cooperation of industry and governments are described and the objectives of COST are reviewed.

C-0713-77
OIL SPILL CONTROL TRAINING: TEXAS A&M UNIVERSITY'S APPROACH
Payne, J. L. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 129-134. (American Petroleum Institute No. 4284)

Personnel training, Oil spills, Texas, *Spill control course

The Oil Spill Control Course conducted at Galveston, Texas, by Texas A&M University's Engineering Extension Service is described. The program's growth and development is briefly documented. Topics of importance include: Educational Objectives, Instructive Modes, and Program Assessment. An outline of the Engineering Extension Services's proposals for updating and expanding its training program is discussed.

C-0714-77
THE PETROLEUM INDUSTRY TRAINING SERVICE - EDMONTON, ALBERTA
Wetmore, W. C. 1976.
Spill Technology Newsletter 1(6):36.

Personnel training, Oil industry, Pollution control, Oil spills, Cleanup, Recovery, Restoration

The Petroleum Industry Training Service (PITS) offers courses and educational services in most phases of the oil and gas industry. Present spill technology courses consist of (1) a three day Oil Spill Containment and Recovery program designed for field foremen and other personnel directly involved in oil spill control; and (2) a three day Oil and Salt Spill Site Rehabilitation Seminar designed for operations management personnel, environmental engineers, field superintendents, foremen and others directly involved in reclamation projects.

B. CONTINGENCY PLANNING

C-0715-77
OIL SPILL CONTROL IN ALBERTA
Bohme, V. E., and E. R. Brushett. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 91-94. (American Petroleum Institute No. 4284)

Contingency planning, Oil spills, Pollution control, Cleanup, Personnel training, Oil industry, Canada

The Energy Resources Conservation Board is responsible for the administration of the oil and gas industry in Alberta. While each oil company is held responsible for containment and cleanup of its own spills, the Board supports the oil spill cooperative concept in spill equipment maintenance, contingency plan preparation, and spill response training. The Board's efforts are aimed at careful containment and cleanup of spills followed by comprehensive evaluation of spill effects for effective rehabilitation programs.

C-0716-77
A DYNAMIC INTERNATIONAL CONTINGENCY PLAN
Corbett, C. R., and C. J. Beckett. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 79-80. (American Petroleum Institute No. 4284)

Contingency planning, U.S., Canada, Oil spills, St. Lawrence River

This paper tells of an international contingency plan, the Joint Canada/United States Marine Pollution Contingency Plan, and how its parties managed the problems confronting them when a major oil spill occurred in the St. Lawrence River on June 23, 1976.

C-0717-77
THE ST. LAWRENCE RIVER OIL SPILL OF JUNE 23, 1976 - ARE YOU EVER TRULY READY?
Foley, J. P., and S. J. Tresidder. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 81-85 (American Petroleum Institute No. 4284)

Contingency planning, Oil spills, Environmental effects, Cleanup, St. Lawrence River

A case study is presented of the title oil spill in which 1.1 million liters (300,000 gallons) of No. 6 oil were released into

St. Lawrence River waters. In a spill incident such as this, it is important that the pre-designated on-scene coordinator (OSC) implements an organizational scheme to make an effective and thorough recovery effort. An approach which was successful on the St. Lawrence River is pointed out.

C-0718-77
OIL SPILL CONTINGENCY PLANNING FOR THE BP FORTIES OILFIELD PRODUCTION, PIPELINE AND TERMINAL SYSTEMS.
Fulleylove, R. J., and T. E. Lester. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 87-90. (American Petroleum Institute No. 4284)

Contingency planning, Oil spills, Cleanup, Personnel training, Oil fields, North Sea, *BP Forties oilfield

The plans and types of problems for BP in developing oil spill contingency plans to cover the entire Forties oil field in the UK sector of the North Sea are discussed. Efforts required include re-examining methods of oil spill cleanup at sea and on land and, taking into account ecological problems, redesigning equipment where necessary; coordinating with relevant authorities; and insuring personnel training.

C-0719-77
THE DEVELOPMENT AND USE OF RESOURCE SENSITIVITY MAPS FOR OIL SPILL COUNTERMEASURES
Hum, S. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 105-110. (American Petroleum Institute No. 4284)

Contingency planning, Oil spills, Canada, *Resource sensitivity maps, *British Columbia

This paper discusses the development and use of resource sensitivity maps to provide optimal protection and to set priorities for equipment and manpower deployment during an oil spill. The maps contain sufficient details of biological resources, current land and water uses, present access and land status, tide-current data and wind patterns to enhance initial decision-making until more detailed information systems are available and on-line. The maps illustrated in this paper cover coastal areas of British Columbia and were developed by the Environmental Protection Service of Environment Canada.

C-0720-77
OIL SPILL RESPONSE PLANNING FOR BIOLOGICALLY SENSITIVE AREAS
Linstedt-Siva, J. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 111-114. (American Petroleum Institute No. 4284)

Contingency planning, Oil spills, Fate, Environmental protection, Santa Barbara Channel, *Clean Seas, Inc.

Oil spill response plans should include the examination of physical processes of the environment in which they will be used so that the fate of spilled oil may be predicted, and biologically sensitive areas that are vulnerable to oil spill damage be identified. Clean Seas, Inc., an oil spill cooperative in Santa Barbara, is implementing such a spill responce plan designed to protect these sensitive areas in the Santa Barbara Channel.

C-0721-77
TECHNICAL SUPPORT OF SPILL CONTROL OPERATIONS
Marian, J. P., W. R. Quanstrom, and R. G. Will. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 101-103. (American Petroleum Institute No. 4284)

Contingency planning, Oil spills, Gasoline, Cleanup, Oil industry, *Standard Oil Co. (Indiana)

Standard Oil Company (Indiana) has established a corporate technical support group to strengthen its response to oil spills and their effects. The group has been organized to advise and provide consultation to line management of the AMOCO companies in dealing with problems resulting from a spill. Two case histories are presented which illustrate the involvement of the support group in control of gasoline spills.

C-0722-77
OIL SPILL CLEAN-UP IN THE BEAUFORT SEA
O'Rourke, C. 1976.
Spill Technology Newsletter 1(6):12-35.

Contingency planning, Oil spills, Cleanup, Beaufort Sea, Ice

The main elements of Canadian Marine Drilling Ltd's (Canmar) Oil Spill Contingency Plan are presented, including the response organization, spill reconnaissance program, and the techniques for cleaning up oil in open arctic waters, ice-infested waters, on and under ice, and along the shoreline. The plan is designed to provide effective logistical and technical responses to a hypothetical well blowout in which oil is lost at the rate of

2,500 barrels per day for one year. Various techniques for cleaning up the spill site and removing spilled oil, primarily by burning, are described and illustrated. Canmar's present and future spill research and development projects are briefly outlined.

C-0723-77
CONTINGENCY PLANNING FOR THE IMPACT OF OIL SPILLS IN DIFFERENT COASTAL ENVIRONMENTS OF CANADA
Owens, E. H. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 115-122. (American Petroleum Institute No. 4284)

Contingency planning, Oil spills, Cleanup, Coasts, Canada

Planning for an oil spill cleanup operation of the coastal zone requires consideration of the physical characteristics of the coast, wave energy levels, and tidal range. Three examples from very different coastal environments in eastern Canada are used to illustrate the importance of understanding the variability of littoral processes and of geological parameters in planning cleanup programs.

C-0724-77
OIL AND SALT WATER SPILLS IN CANADA
Pettigrew, R. K. 1975.
Conference on the Environmental Effects of Oil and Salt Water Spills on Land, Banff, Alberta, 1975. Alberta Environment, and University of Calgary, 1975. p. 1-11.

Contingency planning, Oil spills, Inland, Canada, Personnel training

In this verbatim transcript of a presented paper, the possible responses to oil spills on Canadian lands and waters are outlined. Spill response preparedness, contingency plans and personnel training are briefly discussed, and several case histories of spills are reviewed.

C-0725-77
A WORKSHOP FOR DEFINING THE ROLE OF LOCAL GOVERNMENTS IN OIL SPILL RESPONSE
Putnam, W. H. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 123-127. (American Petroleum Institute No. 4284)

Contingency planning, Oil spills, Cleanup, Pollution control, Economics, *Local governments

The definition of how local governments are to participate under the National Oil and Hazardous Substance Pollution Contingency Plan is outlined with four major headings: protection of the bays, beach cleanup, crowd and traffic control, and funding.

9. PREVENTION AND CONTROL MEASURES

C-0726-77
THE LAW AND PRACTICE RELATING TO POLLUTION CONTROL IN THE MEMBER STATES OF THE EUROPEAN COMMUNITIES
(Authors unknown). 1976.
London, Graham & Trotman Ltd., 1976. 13 volumes.

Pollution control, Legislation, Oil discharges, Europe, *Marine pollution

"A thirteen-volume series which describes the pollution control laws and practices of each country of the European Communities." Among the headings for each book is one dealing with pollution of the seas by oil.

[from brochure of publications, Graham & Trotman Ltd.]

C-0727-77
APPARATUS FOR TANKS INSTALLED ON THE SOIL, ESPECIALLY TANKS CONTAINING LIQUID OILY SUBSTANCES, WHICH IN CASE OF A LEAK AVOIDS THE POLLUTION OF THE GROUND-WATER BODY
Andersen, L. J. 1976.
French Patent 2,281,884

Oil tanks, Leakage, Soil, Pollution prevention, Storage, Design and engineering, Patent

The apparatus consists of a sealing barrier in the soil, surrounding one or more tanks, with its rim protruding a little above the ground level and having its lowest point below the lowest point of the groundwater table. It may include a cover, in the bottom of the tank, under which a well equipped with a suction pipe leads to a small tank with a suction pump located outside the enclosure.

[from Petroleum Abstracts 17(8):#230,633. 1977]

C-0728-77
APPARATUS FOR DETECTING LEAKS IN DOUBLE-WALLED TANKS, WORKING ON THE PRINCIPLE OF OVERPRESSURE
Budde, H., and J. Bahnsch. 1976.
German Patent 2,412,373

Oil tanks, Leakage, Detection, Design and engineering, Patent

A leak detector for storage tanks containing liquids consists of a pump which maintains an overpressure in the control space between the double walls. The pump is equipped with a pressure switch which switches it on and off when the pressure drops and reaches predetermined levels; an additional pressure switch triggers an alarm indicator when the pressure drops below a critical level because of a leak.

[from Petroleum Abstracts 17(8):#230,594. 1977]

C-0729-77
ENVIRONMENTAL PROBLEM DEFINITION FOR PETROLEUM REFINERIES, SYNTHETIC NATURAL GAS PLANTS, AND LIQUEFIED NATURAL GAS PLANTS
Cavanaugh, E. C., J. D. Colley, P. S. Dzierlenga, V. M. Felix, and D. C. Jones. 1975.
NTIS Report PB-252245. 476p.

Pollution control, Refineries, *Natural gas plants, Monitoring, Wastewaters, Solid waste

"Ambient air emissions, liquid effluents, solid wastes, monitoring methods and control techniques are given."

[from Chemical Abstracts 86(2):#8372u. 1977]

C-0730-77
SPCC PLANNING: GOOD MANAGEMENT PRACTICE
Clark, D. A. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 55-56. (American Petroleum Institute No. 4284)

Pollution prevention, Oil spills, Storage, Petroleum products, Contingency planning, *Oil storage plan

Spill Prevention Control and Countermeasure (SPCC) plans are required by the Oil Spill Prevention Program, EPA, for facilities with oil storage capacity above certain minimum amounts. The paper discusses the additional beneficial effects of a good SPCC plan other than the reduction in spill hazard.

C-0731-77
ASPECTS OF WATER POLLUTION IN THE OIL REFINING INDUSTRY [English summary]
Colin, J. 1976.
Industries Alimentaires et Agricoles 93(2):177-183.

Pollution prevention, Refining, Oil industry, Sources

Discussed are the sources of pollution in the production of refined and unrefined oils, and techniques of preventing pollution from cooling water, gas washers, and the decomposition of soapstocks.

[from Chemical Abstracts 85(24):#181847e. 1976]

C-0732-77
A GLOBAL ENVIRONMENT: THE OCEANS
Council on Environmental Quality. 1975.
CEQ Annual Report, 6th, 1975. p. 595-607.

Pollution prevention, Oceans, Storage, Oil spills, Environmental effects

The article discusses exploitation of marine resources, both living and mineral, ocean dumping of harmful wastes, and oil spills. Means for preventing adverse environmental effects from ocean mining and offshore oil storage are described.

[from Environment Abstracts 6(11):#76-07362. 1976]

C-0733-77
OIL SPILL CONTROL. PART 2: COUNTER MEASURES
D'Alessandro, P. L., and C. B. Cobb. 1976.
Hydrocarbon Processing 55(3):145-148.

Oil spills, Pollution control, Detection, Containment, Recovery, Disposal

Methods of detection, containment, recovery, and disposal are reviewed.

[from Chemical Abstracts 85(24):#182002n. 1976]

C-0734-77
CONTROLLING POLLUTION OF THE MARINE ENVIRONMENT: AN ECONOMIC ANALYSIS
Epple, D., and M. Visscher. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 31-34. (American Petroleum Institute No. 4284)

Pollution control, Oil spills, *Costs, Economic effects, Models, *Polluter response

"Using data from the U.S. Coast Guard's Pollution Incident Reporting System (PIRS) and the Port Safety and Security/Marine Environmental Protection Quarterly Activities Report, this paper examines a model describing the behavior of polluters in response to pollution control costs and, in so doing, stresses the potential economic impact. Implications for public policy also are presented."

C-0735-77

EVALUATION OF SELECTED SURFACE TREATMENT AGENTS FOR THE PROTECTION OF SHORELINES FROM OIL SPILLS

Foget, C. R. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 237-241. (American Petroleum Institute No. 4284)

Oil spills, Pollution prevention, Environmental protection, Shorelines, Marshes

The objectives of current research on chemical and natural agents used to protect shoreline or marsh areas from oil contamination are evaluated in the laboratory and in the field. Evaluation includes the environmental effects of the agents, the effects of climate on agent use, longevity of the agents, and ease of agent application.

C-0736-77

PROTECTION OF THE MARINE ENVIRONMENT FROM POLLUTION

Frank, R. A. 1976.
Georgia Journal of International and Comparative Law 6:73-91.

Environmental protection, Ships, Tankers, Inland, Offshore production, Monitoring

Six issues are discussed regarding protection of the marine environment from pollution in the context of the Third UN Conference on the Law of the Sea. Vessel source pollution, land based pollutant sources, pollution from offshore resource-related activities, and environmental monitoring and assessment are among the topics considered.

[from Selected Water Resources Abstracts 10(2):W76-00972. 1977]

C-0737-77

SINKING OF TANKER ST. PETER OFF COLOMBIA

Hayes, T. M. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 289-291. (American Petroleum Institute No. 4284)

Oil spills, Tankers, Environmental protection, Colombia, IMCO

The tanker, "St. Peter", sank in 1,000 m of water off Cape Mangiares, Colombia. The Intergovernmental Maritime Consultative Organization (IMCO) provided technical advice to the Colombian and Ecuadorian governments regarding countermeasures against pollution. The lack of available equipment to locate the sunken vessel, the logistics involved in operations to reduce environmental damage, and the need for a response organization are discussed.

C-0738-77
U.S. NAVY R & D EFFORTS IN SUPPORT OF OIL POLLUTION ABATEMENT STRATEGIES
Hura, M. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 61-63. (American Petroleum Institute No. 4284)

Pollution prevention, Oil discharges, Ships, Waste oil treatment, Cleanup, Monitoring, USN

The basic strategy of the Navy's Oil Pollution Abatement program has been to institute measures that will reduce the amount of oil discharged from ships into the environment wherever possible before implementing oily waste treatment techniques. Navy laboratories have been instrumental in developing techniques and hardware to combat oil pollution. Contributions include shipboard oil/water separators, real-time oil-in-water monitors, and effluent oil spill containment and cleanup equipment.

C-0739-77
REPORT OF THE SYMPOSIUM ON PREVENTION OF MARINE POLLUTION FROM SHIPS HELD IN ACAPULCO, MEXICO 22-31 MARCH 1976
Inter-Governmental Maritime Consultative Organization. 1976.
USCG-WEP-1-77, 143?p.

International conventions, Oil spills, Ships, Oil-water separation, Contingency planning, Pollution prevention, IMCO

Discussed at this symposium were: oil-water separators, oil monitoring equipment, contingency planning, and control and detection methods for dealing with oil spills.

[from Government Reports Announcements 77(1):#AD-A031 581/2GA. 1977]

C-0740-77
ELEMENT AND METHOD FOR DETECTING LEAKAGE OF PETROLEUM PRODUCTS
Kishikawa, H., T. Adachi, and T. Usami. 1976.
U.S. Patent 3,970,863

Leakage, Detection, Petroleum products, Patent

"Coating a laminate or film of petroleum product-swellable butadiene-styrene block copolymer with mixtures containing Ag or Al or coating polystyrene cords with mixtures containing styrene block copolymer and Ag gave materials useful for detection of petroleum leaks."

[from Chemical Abstracts 86(4):#17841y. 1977]

C-0741-77
THE EPA INDUSTRIAL POLLUTION R AND D PROGRAM. PETROLEUM REFINING AND ORGANIC CHEMICALS INDUSTRIES
Lacy, W. J., P. E. Des Rosiers, L. H. Myers, H. Leon, and T. E. Short. 1975.
Preprint, Division of Petroleum Chemistry, American Chemical Society 20(1):274-286.

Pollution control, Oil industry, Refineries, EPA

A review is presented of the Environmental Protection Agency pollution control research and development projects implemented by the petroleum industry.

[from Chemical Abstracts 86(4):#21334c. 1977]

C-0742-77
FAST SURFACE DELIVERY SYSTEM FOR POLLUTION RESPONSE EQUIPMENT
Larrabee, R. M., and R. Ward. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 417-421. (American Petroleum Institute No. 4284)

Oil spills, Pollution control, Cleanup, Design and engineering, USCG, *Equipment delivery system

Performance requirements and design specifications of the U.S. Coast Guard's Fast Service Delivery System are given. Test results show this system to be an efficient means to deliver pollution control equipment to the scene of a high seas oil spill.

C-0743-77
IMPROVEMENTS IN OR RELATING TO BLOWOUT PREVENTERS
Lerouax, H. K. 1976.
British Patent 1,457,562

Blowout prevention, Drilling, Design and engineering, Patent

A blowout preventer adapted to seal with the drill stem in a well bore or to close the bore in the absence of the drill stem consists of the following: 1) a resilient sealing member with an inner surface adapted to engage the drill stem, 2) a rigid retaining plate mounted with the sealing member, 3) means for urging the sealing member radially inward relative to the inner surface of the retaining plate for sealing with the drill stem or with itself so as to close the bore, and 4) anti-extrusion means.

[from Petroleum Abstracts 17(3):#229,038. 1977]

C-0744-77
A BAD DAY AT BUNKER POINT
Marcus, E. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 139-140. (American Petroleum Institute No. 4284)

Oil spills, Personnel training, Pollution control, Contingency planning

The four-phase program by Gulf Trading and Transportation Company (GT&T) to improve existing oil spill policies and procedures is reviewed. The program includes terminal inspection, contingency planning, response teams, and mock spill exercises.

C-0745-77
HACKENSACK ESTUARY OIL SPILL: CUTTING OIL-SOAKED MARSH GRASS AS AN INNOVATIVE DAMAGE CONTROL TECHNIQUE
Mattson, C. P., N. C. Vallario, D. J. Smith, S. Anisfield, and G. Potera. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 243-246. (American Petroleum Institute No 4284)

Oil spills, Pollution control, Estuaries, Marshes, Movement, *Grass-cutting, *Hackensack estuary

Grass cutting technology for the control of oil pollution in the Hackensack estuary and marshland is analyzed and oil slick movement predictions are given.

C-0746-77
PREVENTING OIL SPILLS IN THE WEST COAST FOREST INDUSTRY
Melville, L., and P. Hamm. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 57-60. (American Petroleum Institute No. 4284)

Pollution prevention, Oil spills, Cleanup, Waste oil disposal, *Forest industry

The approach of MacMillan Bloedel, Canada's largest forest products company, to oil spill prevention and cleanup is discussed. The company's enlightened program of establishing control measures, training personnel, and contingency planning has resulted in a significant reduction in the number and magnitude of oil spills during operations.

C-0747-77
PROCESS FOR SEALING PIPE CONNECTIONS
Press (William) & Son Ltd. 1974.
Belgian Patent 815,458

Leakage, Pipelines, Pollution prevention, Patent *Sealing material

A thick annular ring of sealing material is made by introducing castable and hardening sealing agent in a mold which is mounted on the leaky pipe. The mold is dismantled, leaving the sealant completely surrounding the leaky junction.

[from Petroleum Abstracts 17(8):#230,615. 1977]

C-0748-77
LUBRICATING OIL CAUSING LESS POLLUTION PROBLEM
Shimuzu, I. H. Kurita, Y. Beppu, and M. Shibata. 1976.
Japanese Kokai (unexamined patent application) 76 83,606

Pollution control, Lubricating oil, Patent

"Lubricating oils are prepared by mixing base oils containing hydrocarbon oils and optionally olefin polymers with various additives such as anti-oxidants, oiliness improvers, demulsifying agents, corrosion inhibitors, defoaming agents, and viscosity index improvers."

[from Chemical Abstracts 85(22):#163148y. 1976]

C-0749-77
LUBRICATING OIL CAUSING LESS POLLUTION PROBLEM
Shimuzu, I., K. Okada, and M. Shibata. 1976.
Japanese Kokai (unexamined patent application) 76 83,607

Pollution prevention, Lubricating oil, Patent

"Lubricating oils are prepared by mixing base oils containing highly refined hydrocarbon oils with olefin polymers, and optionally 2,6-di-tert-butyl-4-methylphenol, fatty acids, and/or fatty acid esters."

[from Chemical Abstracts 85(22):#163147x. 1976]

C-0750-77
PROCESS FOR DETECTING LEAKS FROM A TANK AND APPARATUS FOR ITS APPLICATION
Slozade, J. E., and D. G. P. Bouvier. 1976.
French Patent 2,270,574

Leakage, Oil tanks, Detection, Design and engineering, Patent

"The tank is subjected to a first hydraulic pressure and the variation of liquid level in a sight glass is measured for a time interval, T; then the tank is subjected to a second hydraulic test pressure and time interval. The difference in liquid levels represents the rate of leakage."

[from Petroleum Abstracts 17(2):#228,832. 1977]

C-0751-77
ARCTIC OFFSHORE OIL SPILL COUNTERMEASURES WITH EMPHASIS ON AN OIL AND GAS BLOWOUT IN THE SOUTHERN BEAUFORT SEA
Thornton, D. E., S. L. Ross, V. J. Logan, and C. W. Ross. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 313-319. (American Petroleum Institute No. 4284)

Oil spills, Blowout prevention, Offshore drilling, Ice, Dispersants, Containment, Incineration

A summary is presented by Environment Canada of arctic offshore oil spill countermeasures projects to assess the potential impact of exploratory drilling for oil and to develop efficient methods of combusting oil on ice. Discussed are ways to evaluate the fate and effects of dispersants in cold sea water, develop dispersant deployment methods, and contain oil from underwater blowouts. For zones of moving ice, the best technique appears to be in-situ burning on the ice surface during the summer.

C-0752-77
THE CONTROL OF OIL POLLUTION ON THE SEA AND INLAND WATER
Wardley-Smith, J. (ed.). 1976.
London, Graham & Trotman Ltd., 1976. 240p.

Pollution control, Oil spills, Oceans, Inland, Environmental effects, Cleanup

This book explains the effect of oil spills on the marine environment and describes the best methods of cleaning up such pollution. The contents are divided into four main topics: (1) Oil and its Effects; (2) Treatment of Oil on Water, (3) Treatment of Oil on the Land,; (4) Organizational Aspects.

[from brochure, Graham & Trotman Ltd.]

C-0753-77
UNDERWATER BLOWOUT OIL COLLECTION
Westergaard, R. H. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 293-298. (American Petroleum Institute No. 4284)

Blowout prevention, Containment, Offshore drilling, Oil spills, North Sea

A feasibility study on underwater oil collection for control of underwater blowouts is presented and equipment operation is discussed. The possibility of a blowout in North Sea operations due to difficulties in containment is also reviewed.

C-0754-77
NEW TEST FACILITIES FOR THE PREVENTION OF OIL POLLUTION IN JAPAN
Yazaki, A. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 429-433. (American Petroleum Institute No. 4284)

Oil spills, Recovery, Pollution prevention, Japan, *Test facilities

Design specifications of new Japanese test facilities for conducting research on developing and evaluating oil-fences and oil-recovery equipment are given. These facilities include a circulating water channel, a rectangular tank, and an oil-water purifier system.

C. EFFECTS OF OIL POLLUTION

1. BIOLOGICAL EFFECTS

C-0755-77
OILS SPILLS ARE NOT FOR THE BIRDS
Anon. 1977.
Science News 111(10):153.

Fuel oil, Birds, Biological effects, Monitoring, *Reproduction

Recent research by C. R. Grau, T. Roudybush, J. Dobbs, and J. Watnen of the University of California, Davis, shows that even tiny amounts of fuel oils can hinder reproduction in a variety of birds. Petroleum oils in quantities too small to obviously harm adult birds were found to result in thinned eggshells, less yolk in eggs, and alterations of the yolk's chemical properties. These changes may be useful in monitoring oil pollution of wild birds.

C-0756-77
SUBLETHAL EFFECTS OF PETROLEUM FRACTIONS ON THE BEHAVIOR OF THE LOBSTER, HOMARUS AMERICANUS, AND THE MUD SNAIL, NASSARIUS OBSOLETUS
Atema, J. 1976.
Estuarine Research Federation Meeting, Houston, 1975. No. CONF-7510104-1. 23p.

Fuel oil, *Kerosene, Biological effects, Behavior, Crustaceans, Mollusks, *Sublethal effects, *Lobster, *Mud snail

The behavior observed varied from feeding attraction to repulsion and feeding inhibition when exposed to concentrations of No. 2 fuel oil and kerosene and its fractions. The author suggests that specific hydrocarbon fractions in specific amounts are responsible for distinct behavioral changes; the fractions are present in variable amounts in different oils; and the behavioral changes are general enough to similarly affect a large number of marine invertebrates.

[from ERDA Energy Research Abstracts 1(9):#01744J. 1976]

C-0757-77
NONNUCLEAR EFFLUENTS: FATE AND EFFECTS OF OIL AND OIL COMPOUNDS ON MARINE COASTAL ECOSYSTEMS
Author unknown. 1976.
Battelle Pacific Northwest Laboratory annual report for 1975, No. BNWL-2000 (Pt. 2). p. 118-126.

Hydrocarbons, Fate, Chronic effects, Contamination, Marine organisms, Coasts, Analytical techniques

Based on information from short-term studies, three problem areas have been identified: (1) a need to stabilize experimental treatment to allow description of treatment and interpretation of observed biological response; (2) a need to develop existing analytical methods having high sensitivity for use as tools complementary to bioassay; and (3) a need to demonstrate the suitability of multi-species biological complexes as laboratory test units.

[from ERDA Energy Research Abstracts 1(9):#17375. 1976]

C-0759-77
ECOLOGICAL EFFECTS OF EXPERIMENTAL OIL SPILLS ON EASTERN COASTAL PLAIN ESTUARINE ECOSYSTEMS
Bender, M. E., E. A. Shearls, and R. P. Ayres. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 505-509. (American Petroleum Institute No. 4284)

Oil spills, Estuaries, Biological effects, Weathering, Plankton, Fishes, Benthos, Atlantic coast

The objective of this research is to determine the ecological effects of weathered and unweathered South Louisiana crude oil spilled into eastern coastal plain estuaries. This paper deals with biotic responses excluding bacteria. Overall, the artificially weathered oil was shown to have as great an ecological impact on the communities as the fresh crude. Phytoplankton and fish populations all showed greater declines following the spills in the weathered oil system. Marsh grass production and benthic populations declined after both oil spills.

C-0759-77
EFFECTS OF SUNKEN OIL ON THE FEEDING OF PLAICE ON BROWN SHRIMPS AND OTHER BENTHOS
Blackman, R. A. A. 1974.
Copenhagen, International Council for the Exploration of the Sea, Fisheries Improvement Committee, 1974. 7p.

Behavior, Fish, Contamination, Benthos, *Sunken oil, *Oil-containing prey, *Feeding

The effects of oil-containing prey and oil from tank bottoms on predation behavior of demersal fish were studied. The fish caught shrimp that had ingested oil more easily because of the shrimp's reduced specific gravity. It was found that food-seeking fish in an oiled area will ingest oil as a potential food.

C-0760-77
EFFECTS OF NO. 2 FUEL OIL, NIGERIAN CRUDE OIL AND USED CRANKCASE OIL ON THE METABOLISM OF BENTHIC ALGAL COMMUNITIES
Bott, T. L., K. Rogenmuser, and P. Thorne. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 373-393. Proceedings of the Symposium, American University, Washington, D.C., 9-11 August 1976.

Toxicity, Fuel oil, Crude oil, Waste oil, Metabolism, Benthos, Algae

In this study, exposure of benthic algal communities to the three title oils was shown to depress the net community primary productivity; the degree of effect was dependent on the type and concentration of the oil used. No. 2 fuel oil had the most toxic effects on community function.

C-0761-77
SENSITIVITY OF LARVAL AND ADULT ALASKAN SHRIMP AND CRABS TO ACUTE EXPOSURES OF THE WATER-SOLUBLE FRACTION OF COOK INLET CRUDE OIL
Brodersen, C. C., S. D. Rice, J. W. Short, T. A. Mecklenburg, and J. F. Karinen. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control Cleanup), New Orleans, March 8-10, 1977. p. 575-578. (American Petroleum Institute No. 4284)

Crude oil, Toxicity, Crustaceans, Alaska, *Water soluble fractions, *Larval stages, *Shrimp, *Crabs

Tests using 96-hour static bioassays at water temperatures normally encountered by the organisms were conducted in the title study. Larvae were found to be more sensitive to oil than adults, and the sensitivity of the larvae was dependent on species and development stage. Greater vulnerability of larvae to oil exposure is probably due to greater susceptibility to oil toxicity and predation. Cold water species are particularly vulnerable because of the long time spent as developing larvae.

C-0762-77
MICROSOMAL MIXED FUNCTION OXIDASES IN AN ESTUARINE FISH, *FUNDULUS HETEROCLITUS*, AND THEIR INDUCTION AS A RESULT OF ENVIRONMENTAL CONTAMINATION
Burns, K. A. 1976.
Comparative Biochemistry and Physiology 53(4b):443-446.

Hydrocarbons, Contamination, Fish, Estuaries, *Microsomal mixed function oxidases, **Fundulus heteroclitus*

In vitro aldrin epoxidation rates were measured in *F. heteroclitus* and compared to those seen in freshwater fish. "The oxidase(s) are microsomal, require NADPH and were poisoned by carbon monoxide (CO) indicating the involvement of a CO binding component." High levels of liver microsomal preparations containing the CO binding cytochrome P450 were induced both by a drug in the laboratory and by contamination of the aquatic environment by foreign hydrocarbons.

[from Environmental Health and Pollution Control 10(7):#1676. 1976]

C-0763-77
EFFECTS OF A SEAWATER-SOLUBLE FRACTION OF COOK INLET CRUDE OIL AND ITS MAJOR AROMATIC COMPONENTS ON LARVAL STAGES OF THE DUNGENESS CRAB, *CANCER MAGISTER* DANA
Caldwell, R. S., E. M. Caldarone, and M. H. Mallon. 1977.
Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms, Seattle, November, 1976.

Crude oil, Toxicity, Crustaceans, *Water-soluble fractions, **Cancer magister* Dana

Larval stages of *C. magister* Dana were exposed continuously to dilutions of Cook Inlet crude oil water-soluble fraction (WSF) or seawater solutions of naphthalene or benzene for periods up to 60 days. Effects on survival, duration of larval development, and size were used as indicators of toxicity. The lowest concentration of WSF at which toxic effects were seen was 4.0% of the full strength WSF (0.0040 mg/l as naphthalene or 0.22 mg/l as total dissolved aromatics). The lowest concentrations at which toxic effects were observed with naphthalene and with benzene were 0.13 mg/l and 1.1 mg/l, respectively. Concentrations of aromatic hydrocarbons in the WSF were inversely related to the degree of alkylation in the benzene and naphthalene families, but acute toxicity was directly related to the degree of alkyl substitution.

C-0764-77

THEORY OF THE SOURCE AND ACCUMULATION OF 3,4-BENZOPYRENE IN THE FOOD CHAIN

Capone, W., M. Cottiglia, C. Mascia, and M. L. T. Masala. 1976.
Inquinamento 18(7-8):35-40.

Aromatic hydrocarbons, Wastewaters, Refineries, Contamination, Mollusks, Food web, *Food chain accumulation, *3,4-benzopyrene

Mussels growing near the waste discharge pipes of a petroleum refinery were collected and examined for 3,4-benzopyrene levels. Those collected 150 m from the discharge pipes were exceptionally small and contained 7.5 μg/kg; those 1000 m distance were of normal size but contained 1342.5 μg/kg. Results of experiments in which contaminated mussels were fed to mullet, and in turn contaminated mullet and mussels were fed to rats and their offsprings are described.

[from Chemical Abstracts 86(5):#26546g. 1977]

C-0765-77

THE EFFECT OF CRUDE OIL EXPOSURE ON ENZYMES IN THE SHRIMP HEPATOPANCREAS

Chambers, J. E., J. D. Yarbrough, and J. R. Heitz. 1975.
Association of Southeastern Biologists 22(2):45. Abstract.

Crude oil, Emulsions, Biological effects, Crustaceans, *Shrimp, *Enzyme activities

The effects of a one day *in vivo* exposure to 10 ppm emulsified crude oil on enzyme activity in the shrimp *Penaeus sp.* were investigated. An American and a Saudi Arabian crude oil were used for comparison, and the latter was found to significantly change enzyme levels in the shrimp, whereas the former caused little if any changes in activity.

C-0766-77

THE FIVE-YEAR RECRUITMENT OF MARINE LIFE AFTER THE 1971 SAN FRANCISCO OIL SPILL

Chan, G. L. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 543-545. (American Petroleum Institute No. 4284)

Oil spills, Biological effects, Restoration, Marine organisms, San Francisco Bay

Five-year observations of marine live recruitment following the spill indicate that population densities of some marine species have significantly increased in the San Francisco Bay area intertidal zones at Sausalito and Duxbury Reef. No evidence has been found of lasting detrimental effects of Bunker C oil on the marine populations within the transect sites.

C-0767-77
OIL POLLUTION AND TROPICAL LITTORAL COMMUNITIES: BIOLOGICAL EFFECTS OF THE 1975 FLORIDA KEYS OIL SPILL
Chan, E. I. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 539-542. (American Petroleum Institute No. 4284)

Oil spills, Biological effects, Tropical regions, Marine organisms, Intertidal zone, Marshes, Coral reefs, Florida coast

This study reports biological effects of the 1975 oil spill in the Florida keys for a one-year period. The effects are discussed by habitat, beginning with the rocky intertidal zone, in which the short-term effects were greatest, and followed by mangrove fringe, grass flats, sandy intertidal, mangrove swamp-*Batis* marsh, and the coral reef community.

C-0768-77
THE BIOLOGICAL CONSEQUENCES OF OIL POLLUTION
Clark, R. C., Jr. 1974.
Oil on Northern Puget Sound. W. H. Gray and J. Everitt (eds.). Pullman, Washington, Washington State University, 1974. Proceedings of a Seminar, Mount Vernon, Washington.

Contamination, Biological effects, Puget Sound

Summary not available.

[from Northwest Fisheries Center Monthly Report. February, 1975]

C-0769-77
THE EFFECTS OF PETROLEUM REFINERY LIQUID WASTES ON AQUATIC LIFE, WITH SPECIAL EMPHASIS ON THE CANADIAN ENVIRONMENT
Côté, R. P. 1976.
Ottawa, National Research Council of Canada, Associate Committee on Scientific Criteria for Environmental Quality, 1976. 77p.

Wastewaters, Refineries, Toxicity, Fish, *Aquatic life, Canada

In Canada, there are specific petroleum refineries whose effluents are highly toxic to fish; however, the majority of refinery effluents tend to be moderately or not acutely lethal. In many cases, petroleum refineries do not contribute large volumes of waste waters to the environment, and there is a continuing trend towards a reduction in effluent volume.

[from Marine Pollution Bulletin 7(12):240. 1976]

C-0770-77
THE EFFECTS OF PETROLEUM HYDROCARBONS ON AQUATIC BIRDS
Dieter, M. P. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 437-446. Proceedings of the Symposium, American University, Washington, D.C., 9-11 August 1976.

Hydrocarbons, Birds, Chemical analysis, Biological effects, Metabolism, Food web, *Eggs

Confirmation and characterization of petroleum hydrocarbons present in eggs and avian tissues are being conducted by gas chromatography/mass spectrometry techniques. Ongoing and planned research projects are outlined which measure the biological effects and toxicity of petroleum hydrocarbons to incubating eggs and adult birds (mallard ducks). Food chain studies with invertebrates and mallards are also being conducted to assess possible effects of indirect petroleum pollution on aquatic birds.

C-0771-77
DISTRIBUTION OF NAPHTHALENES WITHIN EXPOSED *FUNDULUS SIMILUS* AND CORRELATIONS WITH STRESS BEHAVIOR
Dixit, D., and J. W. Anderson. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 633-636. (American Petroleum Institute No. 4284)

Fish, *Naphthalenes, Distribution, Uptake, Release, *Stress behavior, **Fundulus similus*

The fish *Fundulus similus* was exposed to doses of naphthalenes and the distribution of these compounds within the organs and tissues was monitored with time. Uptake and release was relatively rapid; accumulation and retention of naphthalenes in the brain were higher than anticipated. Stress-produced behavioral abnormalities in this fish may correspond to the content of naphthalenes in the brain and other parts of the nervous system.

C-0772-77
TOMANO OIL SPILL IN CASCO BAY: ENVIRONMENTAL EFFECTS AND CLEANUP OPERATIONS
Environmental Protection Agency. 1975.
Washington, D.C., Environmental Protection Agency, 1975. Division of Oil and Special Materials Control, EPA/430/9-75/018. 284p.

Oil spills, Environmental effects, Contamination, Marine organisms, Sediments, Containment, Cleanup, Maine, *Tomano oil spill

The effects of No. 6 oil on marine communities of Casco Bay, Maine, were determined and the effectiveness of containment and cleanup operations was assessed. Sediments and biota from intertidal areas were analyzed for No. 6 oil by gas chromatography; contamination to some degree was found at all stations.

[from Government Reports Announcements 76(26):#PB-257 950/6GA. 1976]

C-0773-77

THE SEDIMENT ENVIRONMENT OF PORT VALDEZ, ALASKA: THE EFFECT OF OIL ON THIS ECOSYSTEM

Feder, H. M., L. M. Cheek, P. Flanagan, S. C. Jewett, M. H. Johnston, A. S. Naidu, S. A. Norrell, A. J. Paul, A. Scarborough, and D. Shaw. 1976.
Final report, EPA/600/3-75-086; Contract R800944-02-0. 348p.

Crude oil, Biological effects, Sediments, Marine organisms, Ecosystems, Alaska

In the title investigation, physical, geological, geochemical, hydrocarbon, and biological features were examined. Bacterial populations were unaffected by single applications of up to 2000 ppm of Prudhoe Bay crude oil or chronic exposures. Three species of copepods exposed to oil in the field significantly increased in density in experimentally oiled plots. In studies of oil uptake and release in intertidal sediments and in the clam, *Macoma balthica*, petroleum was not detectable two months after application to sediments. A significant increase in mortality was noted for *M. balthica* exposed to oil. It is suggested that this widely distributed clam may be a valuable indicator for oil.

C-0774-77

UPTAKE AND RETENTION OF KUWAIT CRUDE OIL AND ITS EFFECTS ON OXYGEN UPTAKE BY THE SOFT-SHELL CLAM, *MYA ARENARIA*

Fong, W. C. 1976.
Journal of the Fisheries Research Board of Canada 33(12):2774-2780.

Crude oil, Metabolism, Mollusks, *Clams, **Mya arenaria*

The gills of *Mya arenaria* are capable of removing finely dispersed oil globules from sea water and accumulating the oil in their tissues. This incorporation is directly related to the lipid content of the tissues. Respiration rates significantly increased in small clams after three weeks exposure to oily sea water.

C-0775-77

THE EFFECT OF CRUDE OIL ON LARVAE OF LOBSTER *HOMARUS AMERICANUS*

Forns, J. M. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 569-573. (American Petroleum Institute No. 4284)

Crude oil, Biological effects, Crustaceans, *Lobster, **Homarus americanus*

Lobsters were exposed to South Louisiana crude oil in flow through systems at concentrations of 0.1 ppm and 1.0 ppm. The study demonstrates reduced survival of developing larval lobsters in the presence of 1.0 ppm unweathered crude oil in seawater. Another less direct effect of oil exposure is the increased vulnerability of affected larvae to predation due to resulting changes in coloration.

C-0776-77

PHYSICAL AND BIOLOGICAL EFFECTS OF EXPERIMENTAL CRUDE OIL SPILLS ON LOW ARCTIC TUNDRA IN THE VICINITY OF TUKTOYAKTUK, N.W.T., CANADA

Freedman, W., and T. C. Hutchinson. 1976.
Canadian Journal of Botany 54(19):2219-2230.

Crude oil, Vegetation, Biological effects, Oil spills, Arctic, Canada

Spills of fresh, unweathered crude oil resulted in rapid damage to, and subsequent death of all aboveground foliage coming in contact with the oil. Most species were defoliated; mosses and lichens were especially susceptible and killed. Within several weeks of the summer oil spills, a limited number of vascular plant species began to develop regrowth shoots. Summer spills were markedly more damaging than equivalent spills released in winter.

C-0777-77

CONSERVATION OF THE JACKASS PENGUIN (*SPHENISCUS DEMERSUS*(L.))

Frost, P. G. H., W. R. Siegfried, and J. Cooper. 1976.
Biological Conservation 9:79-99.

Conservation, Birds, Restoration, South Africa, *Jackass penguin

The population of the jackass penguin, which is confined to the coastal waters of southern Africa, has declined in numbers of unknown magnitude since the early 1900's. This review relates current research and conservation efforts to several factors, including oil pollution, which are believed to affect the population status of the species.

C-0778-77
THE UPTAKE OF NAPHTHALENES BY THE CLAM RANGIA CUNEATA IN THE VICINITY OF AN OIL SEPARATOR PLATFORM IN TRINITY BAY, TEXAS
Fucik, K. W., H. W. Armstrong, and J. M. Neff. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 637-640. (American Petroleum Institute No. 4284)

Hydrocarbons, Mollusks, Uptake, Release, Platforms, Sediments, Texas, *Trinity Bay, *Naphthalenes, *Clam, **Rangia cuneata*

In the title study, clams were sampled from under and near an oil separation platform. Clams under the platform showed the greatest uptake and accumulation of naphthalenes; those from 150 to 1000 m from the platform showed little to no signs of uptake. Under laboratory conditions, depuration of most of the accumulated naphthalenes was achieved by the majority of clams within 47 days. High levels of weathered hydrocarbons believed to come from suspended sediments in Trinity Bay were found to be accumulated by the clams.

C-0779-77
BEHAVIOR AND PATHOPHYSIOLOGY OF SEALS EXPOSED TO CRUDE OIL
Geraci, J. R., and T. G. Smith. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 447-462. Proceedings of the Symposium, American University, Washington, D.C., 9-11 August 1976.

Crude oil, Marine mammals, Biological effects, Metabolism, *Seals

Ringed seals, *Phoca hispida*, and harp seals, *Phoca groenlandica*, were experimentally exposed to light crude oil and the biological effects were monitored. Healthy seals survived twenty-four hour exposures with reversible damage to the eyes; stressed seals died within two hours after exposure. Ingestion of quantities of oil considered reasonable during an oil spill did not cause irreversible damage. Evidence is presented which shows that the ultimate damage from a spill depends on the season, productivity of the area, and variable health status of a seal population.

C-0780-77
FIELD STUDIES ON THE PHYTOTOXICITY OF CRUDE OIL TO SUBARCTIC AQUATIC VEGETATION
Hanna, B. M., J. A. Hellebust, and T. C. Hutchinson. 1975.
Verhandlungen, Internationale Vereinigung fuer Theoretische und Angewandte Limnologie 19(3):2165-2171.

Crude oil, Toxicity, Algae, Vegetation, Lakes, Subarctic regions

The effects of crude oil on a vegetative subarctic aquatic community were determined in field experiments. Algae showed a reduction in productivity greater than that of moss after introduction of crude oil. Surface contamination of oil resulted in significant reductions of chlorophyll a and b concentrations in sedge and horsetails.

[from Selected Water Resources Abstracts 9(21):#W76-11405. 1976]

C-0781-77
EFFECTS OF THE CHESAPEAKE BAY OIL SPILL ON SALT MARSHES OF THE LOWER BAY
Hershner, C., and K. Moore. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 529-533. (American Petroleum Institute No. 4284)

Oil spills, Biological effects, Marshes, Marine organisms, Mollusks, Chesapeake Bay, *Marsh grass

A study was conducted to determine the biological impacts of the February, 1976, Chesapeake Bay oil spill on the marshes of the eastern shore of the Bay. Populations of intertidal mussels, *Modiolus demissus*, and oysters, *Crassostrea virginica*, showed no significant short-term effects. The population of the snail, *Littorina irrorata*, was significantly reduced but appears to be recovering. The marsh grass, *Spartina alterniflora*, showed increased net productivity, increased density, decreased mean height, and increased flowering success.

C-0782-77
OIL SPILL EFFECTS ON VEGETATION AND SOIL MICROFAUNA AT NORMAN WELLS AND TUKTOYAKTUK, N.W.T.
Hutchinson, T. C., J. Hellebust, and M. Telford. 1974.
Environmental Social Committee, Northern Pipelines, Task Force on Northern Oil Development, Report No. 74-14. 111p.

Oil spills, Biological effects, Vegetation, Microorganisms, Soil, Canada

Using experimental crude oil spills on the terrestrial vegetation, effects of spilled oil, different seasons and burned/unburned nature of the sites were examined. Reduction in species diversity, vegetation cover and frequency were monitored. Bryophytes suffered most, but most species were killed or defoliated. The spills severely depleted numbers of soil arthropods even at low concentrations. Little effect was observed on growth and composition of phytoplankton or zooplankton; however, periphyton algae and emergent vegetation were strongly inhibited.

[from Ecological Abstracts 1976(3):#76L/2067. 1976]

C-0783-77
A CONTINUOUS FLOW BIOASSAY SYSTEM FOR THE EXPOSURE OF MARINE ORGANISMS TO OIL
Hyland, J. L., P. F. Rogerson, and G. R. Gardner. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 547-550. (American Petroleum Institute No. 4284)

Marine organisms, Contamination, Acute effects, Chronic effects, Design and engineering, *Continuous flow bioassay system

This report describes the design and operation of a continuous flow-through bioassay system for exposing marine test organisms and their life stages to oil. Short-term lethal and chronic sublethal bioassays were conducted in the system and are summarized. Biological effects observed have ranged from lethal toxicity at oil concentrations of about 10 ppm to sublethal behavioral modifications at about 10 ppb.

C-0784-77
PETROLEUM HYDROCARBONS AND THEIR EFFECTS ON MARINE ORGANISMS, POPULATIONS, COMMUNITIES AND ECOSYSTEMS
Hyland, J. L., and E. D. Schneider. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 463-506. Proceedings of the Symposium, American University, Washington, D.C., 9-11 August 1976.

Crude oil, Hydrocarbons, Toxicity, Petroleum products, Marine organisms, Ecosystems

A review of 114 bioassay and other studies conducted on a wide variety of marine organisms indicates lethal effects of soluble aromatic petroleum hydrocarbons in the 1 to 100 ppm range for adult stages, and typically 0.1 to 1 ppm for the more sensitive larval and juvenile stages. Certain ecologically or commercially important species are adversely impacted in the very low part per billion range. Large differences in sensitivity of various populations and communities of organisms to hydrocarbon contamination are pointed out, and areas in need of further study are identified. Strict controls are suggested for oil-related activities in certain shallow, highly productive continental shelf regions, wetlands and estuaries.

C-0785-77
INFILTRATION OF PETROLEUM PRODUCTS INTO WATER AND THEIR EFFECT ON THE HYDROCHEMICAL REGIME AND PHYTOPLANKTON COMMUNITY [in Russian]
Juknevicius, L., K. Jankevicius. 1975.
Osnovy Bioproduktivnosti Vnutrennikh Vodoemov Pribaltiki, Materialy Nauchnoi Konferentsii po Izucheniyu Vnutrennikh Vodoemon Pribaltiki, 18th, 1975. p. 454-457.

Fuels, Petroleum products, Toxicity, Phytoplankton

The effects of diesel fuel, oil, and gas on Cyanophyta, Chrysophyta, Chlorophyta, and Xanthophyta were determined. In the absence of other toxicants, the health of the phytoplankton community can be used to determine the concentration of hydrocarbons in water.

[from Chemical Abstracts 85(26):#197849t. 1976]

C-0786-77
MICROBIAL RESPONSES AFTER TWO EXPERIMENTAL OIL SPILLS IN AN
EASTERN COASTAL PLAIN ESTUARINE ECOSYSTEM
Kator, H., and R. Herwig. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup),
New Orleans, March 8-10, 1977. p. 517-522. (American Petroleum
Institute No. 4284)

Oil spills, Estuaries, Distribution, Microorganisms, Bacteria

Large volumes of unweathered and weathered crude oil were introduced into a *Spartina* salt marsh enclosed by transite structures allowing tidal exchange in order to evaluate the effects of crude oil spillage on microbial populations. Within several days after the spill, the levels of petroleum-degrading bacteria rose by several orders of magnitude for a period of one year. Mean levels of chitinolytic, cellulytic, heterotrophic bacteria and fungi were not statistically different in the oil and control enclosures.

C-0787-77
STUDIES ON THE SUSCEPTIBILITY OF *ANKISTRODESMUS* SPECIES TO
CRUDE OIL COMPONENTS
Kauss, P. B., and T. C. Hutchinson. 1975.
Verhandlungen, Internationale Vereinigung fuer Theoretische und
Angewandte Limnologie 19(3):2155-2164.

Crude oil, Biological effects, Algae, **Ankistrodesmus*

The response of *Ankistrodesmus* species to crude oil water soluble compounds was tested under laboratory conditions and the results of growth bioassays were reported.

[from Applied Ecology Abstracts 2(11):#2D9871. 1976]

C-0788-77
EFFECTS OF BENZENE ON GROWTH, FAT CONTENT, AND CALORIC CONTENT
OF STRIPED BASS *MORONE SAXATILIS*
Korn, S., J. W. Struhsaker, and P. Benville, Jr. 1976.
Fishery Bulletin 74(3):694-698

Biological effects, Aromatic hydrocarbons, Fishes, **Morone saxatilis*, *Benzene

Exposure of juvenile bass to increasing amounts of benzene resulted in wet weight, dry weight and fat content losses. The inhibitory effect of benzene on growth and fat content may have resulted from impaired food localization. Dry weights of the fish appeared to increase after 4 weeks of exposure, suggesting some acclimatization.

[from Chemical Abstracts 85(23):#172 405g. 1976]

C-0789-77
PETROLEUM SULFUR CONTAINING COMPOUNDS AND AROMATIC HYDROCARBONS IN THE MARINE MOLLUSKS *MODIOLUS DEMISSUS* AND *CRASSOSTREA VIRGINICA*
Lake, J. L., and C. Hershner. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 627-632. (American Petroleum Institute No. 4284)

Aromatic hydrocarbons, Mollusks, Uptake, Release, **Modiolus demissus*, **Crassostrea virginica*, *Petro-sulfur compounds

The title organisms were oiled *in situ* with No. 2 fuel oil, and their retention and release of hydrocarbons and petro-sulfur compounds were observed for a recovery period of four months. Most petroleum compounds were released within 16 weeks. Both mollusks showed an initial enrichment of aromatics relative to saturated hydrocarbons, followed by a more rapid release of aromatics. Mussels selectively retained some aromatics, oysters nonselectively depurated the aromatics. The higher molecular weight petro-sulfur compounds were retained for the longest time periods, and depuration rates for these compounds were similar to those of the aromatic hydrocarbons.

C-0790-77
THE TOXICITY OF A SIMULATED REFINERY EFFLUENT TO SOME FRESH WATER ANIMALS
Lee, D. R., A. L. Buikema, Jr., and J. Cairns, Jr. 1975.
Association of Southeastern Biologists 22(2):63. Abstract .

Wastewaters, Refineries, Toxicity, Freshwater, Fish, Invertebrates, *Lethal concentration

The relative sensitivity of 3 species of fish and 15 species of invertebrates was tested using various concentrations of simulated refinery effluent. After 24 hours the lethal concentration for 50 percent of the exposed organisms ranged from 0.10 for *Daphnia pulex* to 9.2 for *Physa sp.* The usefulness of these animals in testing the toxicity of refinery effluents was assessed.

C-0791-77
CHRONIC EFFECT OF SMALL CONCENTRATIONS OF HYDROCARBONS ON SOME NONSPECIFIC INDEXES OF THE IMMUNOLOGICAL RESPONSE OF ANIMALS [in Russian]
Mamedov, A. M. 1975.
Materialy Nauchnoi Konferentsii Azgosmedinstituta, 1974 (pub. 1975). p. 176-178.

Hydrocarbons, Contamination, Animals, Chronic effects, *Immunological response

The effects of constant and intermittent exposure of rabbits and guinea pigs to about 1 μg/l of petroleum hydrocarbons were studied. The exposure resulted in changes which indicated a mobilization of compensatory reactions to hydrocarbon poisoning and inhibition of immunological response.

[from Chemical Abstracts 86(5):#26666x. 1977]

C-0792-77
THE EFFECT OF OIL ON SEEDLINGS OF THE PIONEER MANGROVE, AVICENNIA INTERMEDIA IN MALAYSIA
Mathias, J. A. [1976?]
International Symposium on the Ecology and Management of Some Tropical Shallow Water Communities, 1976? p. 13. Abstract.

Fuel oil, Biological effects, Plants, Tropical regions, Malaysia, *Pioneer mangrove, *Avicennia intermedia

Plants 15 cm in height and grown in plastic containers in a plant house were subjected to a simulated oil spill. Four concentrations of diesel oil in water were used in experiments continuing for 6 to 12 days. Differences between the 6-day and 12-day treatments were not substantial. Seedlings were killed at concentrations of ≥ 10,000 ppm. Normal growth was altered qualitatively or quantitatively below that concentration. The validity of field extrapolation is discussed.

[from Pollution Abstracts 8(1):#77-00436. 1977]

C-0793-77

THE EFFECTS OF PELAGIC HYDROCARBONS ON THE ROCKY INTERTIDAL FLORA AND FAUNA OF BERMUDA

Maynard, N. G., C. D. Gebelein, and A. Zsolnay. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 499-503. (American Petroleum Institute No. 4284)

Tar, Intertidal zone, Marine organisms, Biological effects, Hydrocarbons, Bermuda

Tar is deposited almost exclusively in the splash zone with the maximum amount accumulating on gently sloping or flat shores. Analyses show that the snails, *Nodilittorina tuberculatus* and *Tectarius muricatus*, which live in the splash zone, have the highest content of hydrocarbons of all animals examined. Animals sampled from adjacent tide pool areas contained no petrogenic hydrocarbons. The presence of tar on the rocks does not appear to adversely affect reproductive potential, size frequency or abundance of animals in the intertidal region below the splash zone.

C-0794-77

THE IMPACT OF OIL ON MARINE LIFE: A SUMMARY OF FIELD STUDIES

Mertens, E. W. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 507-514. Proceedings of the Symposium, American University, Washington, D.C., 9-11 August 1976.

Offshore drilling, Offshore production, Chronic effects, Crude oil, Platforms, Marine organisms

The conclusions of sixteen field studies on the effects of chronic low-level exposure of marine life to oil-related activity are presented. The studies were conducted at Santa Barbara, Lake Maracaibo, Venezuela, Bermuda, and offshore Louisiana. "No measurable effects have been observed on such indicators of the health of the local marine communities as population levels of various organisms; species diversity; and size, growth rate, or reproducibility of various organisms. Moreover, there is no evidence of adverse effects such as abnormal growths and biomagnification of petroleum fractions in the food chain."

C-0795-77
EFFECTS OF WATER POLLUTED BY OIL ON AQUATIC ANIMALS. II. N-PARAFFINS, AROMATIC HYDROCARBONS AND CRUDE OIL CONCENTRATION ON TAINT IN SCALLOP (*PECTEN YESSOENSIS*)
Motohiro, T., and Z. Iseya. 1976.
Hokkaido Daigaku, Sapporo, Japan. Suisangakubu, Hakodate.
Hokkaido Daigaku, Suisangakubu Kenkyu Iho 26(4):267-371.

Biological effects, Hydrocarbons, Contamination, Mollusks, *Scallops, **Pecten yessoensis*

"Taints in scallop adductor muscle were examined organoleptically to assess threshold concentrations of n-paraffins, aromatic hydrocarbons, and crude oil." Neither n-tetradecane nor n-hexadecane was found to cause the taint at 0.3 mg/g. Crude oil, xylene, toluene, and mixtures of hydrocarbons caused taints at 0.1-0.2 mg/g.

[from Pollution Abstracts 8(1):#77-00275. 1977]

C-0796-77
ON THE TOXIC EFFECT OF MINERAL OIL AND PETROLEUM ON THE SELF-PURIFICATION PROCESS IN WATERS [in German]
Muller, D., and H. Hellmann. 1976.
Gas Wasserfach, Wasser, Abwasser 117(8):369-373.

Toxicity, Petroleum products, Hydrocarbons

The disturbance of biological self-purification processes in water by oil products and their soluble fractions was studied. Effects vary according to chemical composition and time of contact. The effects on specific organisms were experimentally determined and compared with the literature.

[from Industrial Wastes Information Bulletin 7(5):#HMS 7770. 1976]

C-0797-77
EFFECTS OF THE MARCH 18, 1973 OIL SPILL NEAR CABO ROJO, PUERTO RICO ON TROPICAL MARINE COMMUNITIES
Nadeau, R. J., and E. T. Bergquist. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 535-538. (American Petroleum Institute No. 4284)

Oil spills, Biological effects, Contamination, Marine organisms, Tropical regions, Coasts, Puerto Rico, *Mangroves, *Turtle grass

The biological impact on coastal communities of the 1973 oil spill of the Greek tanker, "Zoe Colocotronis" into southern Puerto Rico waters is documented. Extensive contamination of the mangroves, beach shoreline, and sublittoral *Thalassia* beds was found. Analysis of sediments in this area indicates that significant levels of petroleum hydrocarbon residues were present as of January, 1976.

C-0798-77
EFFECTS OF PETROLEUM ON SURVIVAL, RESPIRATION AND GROWTH OF MARINE ANIMALS
Neff, J. M., J. W. Anderson , B. A. Cox, R. B. Laughlin, Jr., S. S. Rossi, and H. E. Tatem. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 516-539. Proceedings of the Symposium, American University, Washington, D.C., 9-11 August 1976.

Toxicity, Petroleum products, Aromatic hydrocarbons, Marine organisms, *Sublethal effects, *Respiration, *Growth

Tremendous variations in the toxicity of petroleum products to marine organisms are noted; the generally greater toxicity of refined products correlates directly with their contents of aromatic hydrocarbons, especially phenanthrenes. Significant variations in the sensitivity of marine organisms are pointed out: oceanic species are usually more sensitive than estuarine and benthic species, and larvae and juveniles of a species are often more sensitive than adults. Variable sublethal effects of oil on respiration and growth of different organisms are compared; in most cases, adverse effects are reversible when the animal is returned to clean water.

C-0799-77
ACCUMULATION AND RELEASE OF PETROLEUM-DERIVED AROMATIC HYDROCARBONS BY FOUR SPECIES OF MARINE ANIMALS
Neff, J. M., B. A. Cox, D. Dixit, and J. W. Anderson. 1976.
Marine Biology 38(3):279-289.

Aromatic hydrocarbons, Seawater, Marine organisms, Uptake, Release

Marine animals exposed to oil-contaminated seawater accumulate and retain the aromatic hydrocarbons to a greater extent than the alkanes. Accumulation of aromatic hydrocarbons appears to be a passive process dependent on a partitioning of the hydrocarbons between the exposure water and the tissue lipids.

C-0800-77
EFFECT OF DIESEL OIL ON STREAM LIFE
Patterson, R. R. 1976.
Final report, Statewide Fisheries Investigations. Federal Aid Project F-22-R-17. Job No. B-2. 14p.

Oil spills, Fuel oil, Biological effects, Restoration, Streams, Invertebrates, Fish, New Mexico

Results of three years of sampling the Cimarron River after an oil spill decimated invertebrate and brown trout, *Salmo trutta*, populations in 19.3 km (12 miles) of river indicated that invertebrate populations had essentially recovered to prespill levels in one year. The brown trout population increased to about 64% of prespill number in three years.

C-0801-77
METABOLISM OF BENZO(A)PYRENE AND OTHER XENOBIOTICS BY MICROSOMAL MIXED FUNCTION OXIDASES IN MARINE SPECIES
Philpot, R. M., M. O. James, and J. R. Bend. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 184-199. Proceedings of the Symposium, American University, Washington, D.C., 1976.

Hydrocarbons, PAH, Metabolism, Marine organisms, *Benzo(a)pyrene, *Microsomal mixed-function oxidases

Marine organisms are exposed to a wide variety of hydrocarbons introduced into the marine environment by natural and manmade sources. Many marine animals are able to metabolize petroleum hydrocarbons, especially polycyclic aromatic hydrocarbons, into excretable or activated products. This paper discusses the results of studies on the activity, inducibility, and tissue distribution of microsomal mixed-function oxidase activity of selected marine species using benzo(a)pyrene and other substrates.

C-0802-77
INTERACTIONS BETWEEN THE DEPOSIT FEEDING POLYCHAETE *ARENICOLA MARINA* AND OILED SEDIMENT
Prouse, N. J., and D. C. Gordon, Jr. 1976.
Sources, Effects, & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 407-422. Proceedings of the Symposium, American University, Washington, D.C., 9-11 August 1976.

Contamination, Sediments, Fuel oil, Biological effects, Polychaetes, Metabolism, *Feeding activity, **Arenicola marina*

Concentrations of oil in water and sediment can force the worm *Arenicola marina* to surface or stop feeding activity. Lower concentrations reduce the rate of cast production and apparently feeding. The bioturbation and ingestion of oil by the worm can be an important factor in the weathering of oil in sediments, especially those of the lower intertidal zone.

C-0803-77
TOXICITY OF COOK INLET CRUDE OIL AND NO. 2 FUEL OIL TO SEVERAL ALASKAN MARINE FISHES AND INVERTEBRATES
Rice S. D., J. W. Short, and J. F. Karinen. 1976.
Sources, Effects, & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 394-406. Proceedings of the Symposium, American University, Washington, D.C., 9-11 August 1976.

Crude oil, Fuel oil, Toxicity, Marine organisms, Alaska, Fish, Invertebrates, Intertidal zone

Median tolerance levels of 27 different marine Alaskan invertebrate and vertebrate species to water soluble fractions of crude oil and No. 2 fuel oil were determined using a 96-hour static bioassay method. The two oils were equally toxic, fish were consistently among the most sensitive species, and intertidal invertebrates were consistently among the most resistant species. Alaskan marine species appear to be slightly more sensitive than those of temperate regions; this difference in sensitivity may be due to the greater persistence of toxic hydrocarbons at the lower temperatures.

C-0804-77
BIOAVAILABILITY OF PETROLEUM HYDROCARBONS FROM WATER, SEDIMENTS, AND DETRITUS TO THE MARINE ANNELID, *NEANTHES ARENACEODENTATA*
Rossi, S. S. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 621-626. (American Petroleum Institute No. 4284)

Hydrocarbons, Uptake, Metabolism, Release, Polychaetes, Sediments, Seawater, *Neanthes arenaceodentata

Seawater solutions and sediments artificially contaminated with radio-labeled naphthalenes and No. 2 fuel oil water-soluble fractions were used to examine the uptake, retention, metabolism and depuration of diaromatic hydrocarbons by polychaete worms. This paper summarizes the analytical procedures and discusses the results. The worms rapidly accumulated, metabolized, and slowly released hydrocarbons in solution. However, petroleum hydrocarbons adsorbed to sediment particles or particulate organic matter were found to be less available to the worms for accumulation.

C-0805-77
INTERACTIONS BETWEEN PETROLEUM HYDROCARBONS AND THE POLYCHAETOUS ANNELID, *NEANTHES ARENACEODENTATA*: EFFECTS ON GROWTH AND REPRODUCTION; FATE OF DIAROMATIC HYDROCARBONS ACCUMULATED FROM SOLUTION OR SEDIMENTS
Rossi, S. S. 1976.
Ph.D. dissertation, Texas A&M University. 106p.

Hydrocarbons, Fuel oil, Polychaetes, Biological effects, Uptake, Metabolism, **Neanthes arenaceodentata*

The effects of water soluble fractions (WSFs) from No. 2 fuel oil on growth and reproduction of *Neanthes arenaceodentata* were studied. Uptake, retention, and metabolism of diaromatic hydrocarbons by this polychaete were examined.

[from Dissertation Abstracts International B 37(3):1142B-1143B. 1976]

C-0806-77
FLOW-THROUGH SYSTEM FOR CHRONIC EXPOSURE OF AQUATIC ORGANISMS TO SEAWATER-SOLUBLE HYDROCARBONS FROM CRUDE OIL: CONSTRUCTION AND APPLICATIONS
Roubal, W. T., D. H. Bovee, T. K. Collier, and S. I. Stranahan. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 551-555. (American Petroleum Institute No. 4284)

Marine organisms, Hydrocarbons, Crude oil, Chronic effects, Fish, Design and engineering, *Flow-through system

A flow-through system for use with crude oil has been devised which can be easily maintained and adjusted and can be used when large amounts of oil residues accumulate in the equipment. The system was tested by exposing young coho salmon (*O. kisutch*) to the water-soluble fraction of crude oil in seawater at 10°C for five weeks. Analyses of muscle tissue revealed that such hydrocarbons are readily sequestered in the fish tissue.

C-0807-77
A PRELIMINARY STUDY OF THE TOXIC EFFECTS OF IRRADIATED VS. NON-IRRADIATED WATER SOLUBLE FRACTIONS OF #2 FUEL OIL
Scheier, A., and D. Gominger. 1976.
Bulletin of Environmental Contamination and Toxicology 16(5): 595-603.

Toxicity, Fuel oil, Marine organisms, Estuaries, Delaware, *Ultraviolet radiation

The toxic effects of the water soluble fraction of #2 fuel oil on five aquatic species were measured in the Delaware Estuary and in a laboratory using ultraviolet light. Irradiated oil exhibited more toxic properties than non-irradiated oil.

C-0808-77

RESPONSES OF THE CLAM MACOMA BALTHICA TO PRUDHOE BAY CRUDE OIL

Shaw, D. G., A. J. Paul, and E. R. Smith. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 493-494. (American Petroleum Institute No. 4284)

Crude oil, Biological effects, Mollusks, Sediments, Behavior, Chemical analysis, *Clam, *Macoma balthica

The title study was conducted under laboratory conditions designed to simulate the stranding of oil on intertidal sediments in which M. balthica resides. The relationship of dry tissue weight to shell length was not significantly altered by exposure to oil at a level which did result in significant mortalities. Findings suggest that oil-induced death in M. balthica is caused by a metabolically specific mode of poisoning rather than by a general weakening of the animal. In an experiment where animals were subjected to two separated oil events, cumulative effects were not observed in mortalities or in gas chromatographic analysis of tissues for hydrocarbons.

C-0809-77

THE EFFECTS OF AQUEOUS EXTRACTS OF CRUDE OIL AND NAPHTHALENE ON THE PHYSIOLOGY AND MORPHOLOGY OF A FRESHWATER GREEN ALGA

Soto, C., J. A. Hellebust, and T. C. Hutchinson. 1975.
Verhandlungen, Internationale Vereinigung fuer Theoretische und Angewandte Limnologie 19(3):2145-2154.

Crude oil, *Naphthalene, Toxicity, Freshwater, Algae, Metabolism, *Chlamydomonas angulosa

The effects of aqueous crude oil extracts and naphthalene on the green alga, Chlamydomonas angulosa, were investigated. Growth inhibition, photosynthetic capacity, physiological responses, and morphological changes were monitored; results showed naphthalene to be more harmful than crude oil.

[From Applied Ecology Abstracts 2(10):#2D8824. 1976]

C-0810-77

ASPECTS OF THE METABOLISM OF PETROLEUM HYDROCARBONS ON INTERMEDIARY METABOLISM AND XENOBIOTIC METABOLISM IN MARINE FISH

Stegeman, J. J., and D. J. Sabo. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 423-436. Proceedings of the Symposium, American University, Washington, D.C., 9-11 August 1976.

Contamination, Hydrocarbons, Metabolism, Fishes, Biological effects

In the title study, metabolic function in tissues of fish exposed to low levels of petroleum contamination is described. Petroleum hydrocarbons resulted in altered patterns of lipid metabolism characterized by a net decline in lipogenesis in the hepatic, gill, muscle, and brain tissues. Some evidence suggests that induction of mixed-function oxidases occurs in fish environmentally contaminated by petroleum.

C-0811-77

THE SUBLETHAL EFFECTS OF NATURAL CHRONIC EXPOSURE TO PETROLEUM ON MARINE INVERTEBRATES

Straughan, D. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 563-568. (American Petroleum Institute No. 4284)

Crude oil, Natural seepage, Chronic effects, Marine organisms, Mollusks, Santa Barbara Channel

The title study was conducted over a two-year period using Coal Oil Point as the area of natural chronic exposure of petroleum, and series of other sites in Southern California as control sites. Data obtained from studies of abalone and mussels in these areas indicate that marine invertebrates can live and breed in areas of chronic exposure to petroleum higher than that recorded in oil producing areas in the Santa Barbara Channel.

C-0812-77
TEMPERATURE EFFECTS OF CRUDE OIL IN THE UPPER INTERTIDAL ZONE
Straughan, D. 1976.
Final report, EPA/600/2-76/127. 64p.

Crude oil, Biological effects, Intertidal zone, Crustaceans, *Barnacles, **Chthamalus fissus*

Laboratory and field tests were conducted to determine the effects of heavy black asphaltic Santa Barbara crude oil on the intertidal barnacle, *Chthamalus fissus*. This type of oil acts as a black body and has had a long term influence on *C. fissus* distribution after the oil has developed a hard surface crust.

[from Government Reports Announcements 76(22):#PB-255 956/5GA. 1976]

C-0813-77
WHAT HAVE WE FOUND AT THE SEVENTY-FIRST PARALLEL AND WHERE DO WE GO FROM THERE
Underwood, D., and A. Callahan. 1975.
Naval Research Reviews 29(5):18-34.

Oil spills, Arctic, Plants, Animals, USN

The impact of oil spills on arctic plant and animal life is being investigated by the U.S. Navy's NARL research program. The facilities at NARL field stations and the Animal Research Facility are described.

[from Oceanic Abstracts 13(6):#76-05459. 1976]

C-0814-77
EFFECTS OF PETROLEUM ON MARINE INTERTIDAL COMMUNITIES
Vanderhorst, J. R., C. I. Gibson, L. J. Moore, and P. Wilkinson. 1975.
Pacific Northwest Laboratory Annual Report for 1974, BNWL-1950, Pt. 2. p. 110.

Crude oil, Biological effects, Marine organisms, Intertidal zone

Petroleum effects on marine intertidal communities were studied by 1) treating artificial substrates with Prudhoe Bay crude oil and determining the influence of treatment to subsequent settling and growth of marine intertidal communities in situ, 2) determining the feasibility of delivering the soluble phase of crude petroleum to laboratory held communities; and 3) exposing coonstripe shrimp (*Pandalus danae*) in acute bioassays and determining mortality and oil in water concentrations as a function of mixing.

[from A Bibliography of Environmental Research: Ecosystems Department 1952-1975. Battelle-Northwest, No. BNWL-SA-4655. p. 130]

C-0815-77
EFFECTS OF A CONTINUOUS LOW-LEVEL NO. 2 FUEL DISPERSION ON LABORATORY-HELD INTERTIDAL COLONIES
Vanderhorst, J. R., R. M. Bean, L. J. Moore, P. Wilkinson, C. I. Gibson, and J. W. Blaylock. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 557-561. (American Petroleum Institute No. 4284)

Fuel oil, Dispersions, Marine organisms, Intertidal zone, Biological effects, Chemical analysis, *Species diversity

In the title study initial colonies of approximately 83 species of marine intertidal plants and animals were continuously exposed for six months to 0.1 and 0.6 mg/l of No. 2 fuel oil dispersions. Hydrocarbon monitoring and analyses were performed by IR analysis of CCl_4 extracts, supplemented by standard gas chromatography and mass spectrometry methods. Species diversity and total number of species were significantly lower in treated colonies; relative abundance was not significantly affected. Hydrocarbon compositions remained similar to the parent oil and selective enrichment of aromatic hydrocarbons was not observed.

C-0816-77
OIL SPILLS: RISKS AND RELEVANCE (letter to the editor)
Williams, L. W. 1977.
Science 195(4279):636.

Oil spills, Tankers, Toxicity, Marine organisms, *Nannoplankters

This letter takes issue with a recent editorial article [Science 195(4274):137] entitled "Oil Spills" in which the editor concludes that catastrophe from oil spills has little basis in fact. The writer has studied the effects of World War II-related oil spills and recent offshore activity to nannoplankters and finds that not only the oil, but lipid-soluble metals released by weathering oil are toxic to such organisms.

C-0817-77
PHYSIOLOGICAL EFFECTS OF CRUDE OIL EXPOSURE IN THE STRIPED MULLET, *MUGIL CEPHALUS*
Yarbrough, J. D., J. R. Heitz, and J. E. Chambers. 1976.
Life Sciences 19(5):755-760.

Crude oil, Biological effects, Fish, Metabolism, Estuaries, *Mullet

Juvenile mullet were exposed to Empire Mix crude oil for a three week period in a simulated estuarine ecosystem. Compared to control mullet, the oil exposure increased the liver weight to body weight ratio, elevated the alkaline phosphatase activity in the gills and muscles, and elevated the β-glucuronidase and the malic dehydrogenase levels in muscles. The latter effect indicates changes in aerobic metabolism in response to the stress of crude oil exposure on experimental mullet.

B. ECONOMIC EFFECTS

C-0818-77
SHELL SAYS "SOCIETY MUST PAY"
Anon. 1977.
Marine Pollution Bulletin 8(1):4-5.

Oil spills, Economic effects, Toxicity, Pollution control, *Shell Oil Co.

Shell's stand on pollution control costs is presented and current research on the toxicity, control, and dispersal of oil spills is discussed.

C-0819-77
CHEMICAL CARCINOGENS IN THE MARINE ENVIRONMENT. I. BENZO(a)PYRENE IN ECONOMICALLY-IMPORTANT BIVALVE MOLLUSCS FROM OREGON ESTUARIES
Mix, M. C., R. T. Riley, K. I. King, S. R. Trenholm, and R. L. Schaffer. 1977.
Symposium on Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms, Seattle, 1976.

PAH, Carcinogens, Mollusks, Estuaries, Oregon, Economic effects, *Benzo(a)pyrene

Benzo(a)pyrene (BAP) levels were determined in economically-important indigenous shellfish populations from several sites in five Oregon bays. Detectable levels of BAP were present in bivalves from 43 of the 44 sampling sites. High levels (> 15 ng/g) were present in mussels collected from the Newport bayfront in Yaquina Bay and from a marina in Tillamook Bay. Significant levels (> 5 ng/g) were present in Mya arenaria collected along the shipping docks in Coos Bay.

C-0820-77
ESTIMATES OF SOCIO-ECONOMIC DAMAGES OF AN OIL SPILL
Rosenblum, I., and A. Jernelov. 1975.
IVL (Institutet for Vatten-och Luftvardsforskning)
Publication No. B 264. 23 p.

Oil spills, Social effects, Economic effects, Fisheries, Caribbean Sea, *Guatemala

The impact of an oil spill in the Caribbean Sea off the Guatemala coast in April, 1975, was evaluated as to the duration of its effects and the economic losses involved. The bulk of the damage consisted of financial losses to 43% of the population in the communities due to the interruption of fishing activities for an average of 15 days and reduced catch for 75 days after the spill occurrence.

[From Selected Water Resources Abstracts 9(24): #W75-12947. 1976]

3. GENERAL EFFECTS

C-0821-77
OIL SPILLS (editorial)
Abelson, P. H. 1977.
Science 195(4274):137.

Oil spills, Tankers, Toxicity, Fate, Hydrocarbons, Argo Merchant spill

The fate and effects of the Argo Merchant oil spill are shown not to be ecologically disastrous; physical and biological processes which break down and detoxify hydrocarbons are reviewed. Biosynthetic production of hydrocarbons is reported as being equivalent to hydrocarbons contributed by petroleum sources through transportation loss and river and urban runoff.

C-0822-77
MAJOR CONTAMINANTS IN THE MARINE ENVIRONMENT [English summary]
Bernhard, M., and A. Zattera. 1975.
Ingegneria Ambientale 4(3):186-207.

Contaminants, Oceans

"A review with about 400 references."

[from Chemical Abstracts 86(2):#8463z. 1977]

C-0823-77
"SLIKTRAK" - A COMPUTER SIMULATION OF OFFSHORE OIL SPILLS, CLEANUP, EFFECTS AND ASSOCIATED COSTS
Blaikley, D. R., G. F. L. Dietzel, A. W. Glass, and P. J. vanKleef. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 45-52. (American Petroleum Institute No. 4284)

Models, Oil spills, Fate, Movement, Cleanup, Cost analysis, Statistical analysis

"SLIKTRAK", developed by Shell, applies a slick description and combat concept, developed within the E&P Forum for well blowouts in the North Sea, but applicable to other areas as well. This concept includes costs for cleanup, damages and the effect of phenomena such as evaporation and natural dispersion."

C-0824-77
IMPACT OF OIL SPILLAGE FROM WORLD WAR II TANKER SINKINGS
Campbell, B., E. Kern, and D. Horn. 1977.
Massachusetts Institute of Technology, Report MITSG 77-4. 86p.

Oil spills, Tankers, Fate, Environmental effects, Models,
Wildlife, Economic effects, *World War II spills

The overall effects of spilled oil were studied through an extensive literature and archives search of data on tankers sunk along the eastern U.S. coast during World War II. Cape Hatteras, North Carolina, and its surrounding area and the Ashbury Park area of New Jersey were selected as sites for the investigation. A computer model was developed to simulate the trajectory of oil released from each ship. Effects of spills, as reported by residents of both areas, were minimal; regional wildlife and the economy survived with minimal difficulty.

C-0825-77
SOME STUDIES OF AN OIL SPILLAGE DUE TO THE JACOB MAERSK ACCIDENT
Canelas, L. D., and J. D. Calejo Monteiro. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 281-288. (American Petroleum Institute No. 4284)

Oil spills, Environmental effects, Hydrocarbons, Cleanup,
Dispersants, Shorelines, Portugal

A preliminary survey to study the long-term environmental effects of the Jacob Maersk spill in Leixoes harbor is presented; hydrocarbon levels along the shoreline adjacent to the spill are given. The use of dispersants and detergents in cleanup operations is discussed and recommendations for actions during future spill incidents are given. Non-polar hydrocarbon contamination at the harbor and on the beaches was not too intense, as the first analysis was carried out a week after the spill and a large part of the oil had been burned, blown to sea, and cleaned up.

C-0826-77
MOPPING UP THE MESS (book review)
Clark, R. B. 1977.
Marine Pollution Bulletin 8(1):23.

Oil spills, Environmental effects, Biodegradation, Sources,
Cleanup, Recovery, *Book review

A review is given of the book, "The Control of Oil Pollution on the Sea and Inland Waters. The Effects of Oil Spills on the Marine Environment and Methods of Dealing with Them". Sections include: biodegradation, environmental effects of oil and chemical agents, sources of oil pollution, booms, skimmers, dispersants, and absorbents.

C-0827-77
AN OVERVIEW OF THE ISSUES RELATED TO THE IMPACT OF OIL ON NORTHERN PUGET SOUND
Clark, R. 1974.
Oil on Northern Puget Sound. W. H. Gray and J. Everitt (eds.).
Pullman, Washington, Washington State University, 1974.
Proceedings of a Seminar, Mount Vernon, Washington.

Contamination, Environmental effects, Puget Sound

Summary not available.

[from Northwest Fisheries Center Monthly Report. February, 1975]

C-0828-77
THE ARGO MERCHANT OIL SPILL (letter to editor)
Farrington, J. W., H. L. Sanders, J. M. Teal, and J. F. Grassle. 1977.
Science 195(4282):932.

Oil spills, Tankers, Argo Merchant spill, Hydrocarbons, Fate, Toxicity

This letter takes issue with a recent editorial article [Science 195(4274):137] entitled, "Oil Spills". The writers state that the editorial incorrectly compares annual biosynthesis of hydrocarbons with annual inputs into oceans from petroleum hydrocarbons and does not point out the important differences in composition and toxicity between these two categories. The rapidity of evaporation of low-molecular weight hydrocarbons after a spill is questioned, and the sinking of tar balls by various means as a method of removing oil from the ocean surface is criticized because it merely incorporates toxic hydrocarbons in the benthic ecosystem.

C-0829-77
APPLIED ECOLOGY: A NONTECHNICAL APPROACH
Hinckley, A. D. 1976.
New York, Macmillan Publishing Company, 1976. 342p.

Contamination, Environmental effects, Development, Coasts, Legislation, *Ecology

Among the topics covered in this book are history and scope of ecology, impact of man and his technology, aquatic ecosystems, coastal utilization, water conservation, several types of pollution including oil, environmental modeling, and environmental law.

[from Pollution Abstracts 8(1):#77-00664. 1977]

C-0830-77
THE HONG KONG SEA-SHORE - AN ENVIRONMENT IN CRISIS
Morton, B. S. 1976.
Environmental Conservation 3(4):243-254.

Contamination, Shorelines, Japan, Development, Environmental effects, Marine organisms

The reasons for the erosion and, in some cases, destruction of Hong Kong's littoral fauna are discussed in this paper. The various forms of pollution of the shorelines are described, including human and agricultural effluents, land reclamation, oil, heavy metals, mill wastes, freshwater runoff, and coastal development.

C-0831-77
POLYCYCLIC AROMATIC HYDROCARBONS IN THE MARINE ENVIRONMENT [In Norwegian]
Palmork, K. H. 1974.
Nordforsk, Havforskningsinst, Fiskeridir, Bergen, Norway
Miljoevardssekretariatet 4:99-125.

PAH, Oceans

Summary not available.

C-0832-77
MARINE AND ESTUARINE POLLUTION
Reish, D. J., T. J. Kauwling, and A. J. Mearns. 1976.
Journal Water Pollution Control Federation 48(6):1439-1459.

Oil spills, Contamination, Oceans, Estuaries, Biological effects, Fate, Environmental effects, Marine organisms, Bibliographies

This literature review includes a section on oil pollution in which forty-five recent articles (1974-1975) on oil pollution of marine and estuarine environments are incorporated. Included are papers on the fate of oil, biological, and environmental effects of oil spills and oil contamination, and the biodegradation and metabolism of oil, dispersants, and refinery effluents.

C-0833-77
OIL SPILLS: RISKS AND RELEVANCE (letter to the editor)
Sills, D. L. 1977.
Science 195(4279):836.

Oil spills, Tankers, Argo Merchant spill, Law enforcement, Regulations

The letter is in response to a recent editorial article [Science 195(4274):137] entitled, "Oil Spills", which focussed in part on the grounding of the oil tanker "Argo Merchant" in December, 1976. The inadequate enforcement of existing tanker regulations is emphasized, and the apparent inability of government institutions to make and enforce public policy on scientific-technical issues is pointed out.

C-0834-77
ENVIRONMENTAL POLLUTION AND CONTROL
Vesilind, P. A. 1975.
Ann Arbor, Michigan, Ann Arbor Science Publishers, 1975. 232p.

Environmental effects, Pollution control, Regulations, Legislation, U.S.

In this introduction to environmental pollution, all major pollutants except radiation are described. Pollutant effects, methods of control, and pollution standards, regulations and legislation with emphasis on the U.S. are discussed.

D. EFFECTS OF OIL EXPLORATION AND PRODUCTION

1. BIOLOGICAL EFFECTS

C-0835-77
BIOLOGICAL CONSIDERATIONS
Barber, R. T. 1976.
Bureau of Land Management's Environmental Studies Program for the South Atlantic Outer Continental Shelf Area, Conference/Workshop Proceedings. M. F. Massoglia (compiler). Research Triangle Park, North Carolina, Research Triangle Institute, 1976. p. 109-112. Held at Atlanta, Georgia, 1976.

Oil spills, Offshore development, Biological effects, Marine organisms, OCS, Atlantic Ocean

The South Atlantic OCS is dominated by horizontal along-shelf and cross-shelf circulation. A thorough understanding of this advective pattern is necessary in order to predict the effects of oil spills on the biota and susceptible parts of the marine environment.

[from Selected Water Resources Abstracts 9(21):#W76-11404. 1976]

C-0836-77
A BIOLOGICAL SURVEY OF OIL PLATFORMS IN THE SANTA BARBARA CHANNEL
Bascom, W., A. J. Mearns, and M. D. Moore. 1976.
Journal of Petroleum Technology. November:1280-1284.

Platforms, Biological effects, Offshore drilling, Marine organisms, Santa Barbara Channel

The findings are given of a study conducted in 1975 to assess the present status of the sea life on and near two offshore structures and to compare the quantity and quality of life there with that which lived at the towers several years ago and with that at nearby control sites. It was found that life on and around the platforms is healthy and shows no indication of the uptake of any toxicant. Species diversity and abundance are greater than at control sites.

C-0837-77
SCIENTISTS PRESENT FRESH WARNING ABOUT OIL DRILLING ON GEORGES BANK (news brief)
Day, G. 1977.
National Fisherman 57(10):16A.

Oil spills, Offshore drilling, Environmental effects, Fisheries, Marine organisms, *Georges Bank

The environmental effects of oil spills on Georges Bank are discussed and adverse effects to fisheries and bottom fauna, including shellfish, are presented.

C-0838-77

EFFECTS OF DRILL MUD ON SEDIMENT CLEARING RATES OF CERTAIN HERMATYPIC CORALS

Thompson, J. H., and T. J. Bright. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 495-498. (American Petroleum Institute No. 4284).

Drilling, Sediments, Corals, *Drill mud, *Cleaning rates

Three species of hermatypic corals were subjected to large uniform doses of four sediments: used whole drill mud, barite, aquagel, and calcium carbonate. Rates of sediment clearance by each species were measured. No corals were able to remove the used whole drill mud, but all could rid themselves effectively of the other three sediments.

C-0839-77

BIOLOGICAL SERVICES PROGRAM

U.S. Fish and Wildlife Service. 1976.
Washington, D. C., Office of Biological Services, 1976. 52 p.
PB-251 738.

Development, Oil shale, Biological effects, Fish, Wildlife, *U.S. Fish and Wildlife Service

The Biological Services Program of the U.S. Fish and Wildlife Service was begun in 1974 to provide information to decision makers regarding fish and wildlife values in programs associated with energy research and development. Project areas include terrestrial habitats and fauna disturbed by oil shale, coal or geothermal development; freshwater impingements associated with water allocation and stream channelization; and coastal and offshore management.

[From Energy Review No. 17:17. 1976]

2. PHYSICAL EFFECTS

E-0840-77
PHYSICAL OCEANOGRAPHY CONSIDERATIONS
Rinkel, M. 1976.
Bureau of Land Management's Environmental Studies Program for the South Atlantic Outer Continental Shelf Area, Conference/Workshop Proceedings. M. F. Massoglia (compiler). Research Triangle Park, North Carolina, Research Triangle Institute, 1976. p. 103-105. Held at Atlanta, Georgia, 1975.

Contaminants, Offshore exploration, Spreading, Dispersions, Platforms, Oil transport

Transport mechanisms which introduce, spread and disperse oil contaminants in the marine environment during exploration and development activities are discussed. Bottom transport of contaminants around platforms may be a more important factor than previously recognized.

[from Selected Water Resources Abstracts 9(21):#W76-11483. 1976]

3. SOCIAL EFFECTS

C-0841-77
PROCEEDINGS OF THE CONFERENCE TO REVIEW THE DRAFT STUDY PLAN FOR SOCIAL AND ECONOMIC IMPACT ASSESSMENT OF ALASKA OUTER CONTINENTAL SHELF PETROLEUM DEVELOPMENT
Rosenberg, D. H. 1975.
Sea Grant-75-14, NOAA-76052801; Grant NOAA-04-5-158-35. 142 p.

Offshore development, Socio-economic effects, OCS, Alaska

The proceedings of the public conference held in Anchorage, Alaska, to discuss the Draft Study Plan for the Outer Continental Shelf (OCS) petroleum development in Alaska are presented.

[from Government Reports Announcements 76(22):#PB-256 813/76A. 1976]

4. ECONOMIC EFFECTS

C-0842-77
OIL INDUSTRY: BIG POLLUTION-CONTROL COSTS AHEAD? (news brief)
Anon. 1976.
Chemical Engineering 83(27):25.

Regulations, Pollution control, Economics, Oil industry, Refining, Exploration, Production

The American Petroleum Institute projects environmental regulations may cost the U.S. petroleum industry $10 billion yearly starting in 1985, with refining and exploration and production accounting for 90% of this cost.

C-0843-77
RESPONSES OF INDUSTRY WITHIN ABERDEEN TO OIL RELATED CHANGE: SOME IMPLICATIONS FOR URBAN PLANNERS
Hunt, D. 1976.
The International Journal of Environmental Studies 9(4):269-278.

Offshore development, Economic effects, Onshore impacts, Scotland

The growth of onshore supply centers due to development of offshore oil reserves is discussed. Aberdeen, Scotland is used as an example of a mature economy that was transformed by oil related industrial activity.

C-0844-77
REVIEW OF OFFSHORE EXPLORATION IN FLORIDA
Stafford, J. W. 1975.
Florida Coastal Policy Study: The Impact of Offshore Oil Development. A. L. Pearman and J. W. Stafford (eds.). Florida State University, and University of South Florida, 1975 (reprinted 1976). Chapter II. p. 31-53. Final report.

Offshore exploration, Oil-gas leasing, Economic effects, Florida, Onshore impacts

Recent offshore Florida oil-gas leasing and exploration activities are chronologically reviewed, and the characteristics of associated offshore and onshore facilities are examined. Past economic impacts of oil exploration on several Florida communities are assessed, and the potential positive and adverse economic effects of such development are considered.

5. GENERAL EFFECTS

C-0845-77
EFFECTS ON COMMERCIAL FISHING OF PETROLEUM DEVELOPMENT OFF THE NORTHEASTERN UNITED STATES
Allen, D. W., R. B. Allen, R. E. Black, J. M. Friedman, and L. G. Mallon. 1976.
WHOI-76-66, NOAA-76080904. Grant NOAA-04-6-158-44016. 78p.

Offshore development, Environmental effects, Fisheries, U.S., Regulations, Oil industry

The effects of petroleum development on the onshore and offshore interactions of fisheries are described. Environmental effects and legal and regulatory framework governing the oil industry are also discussed.

[from Government Reports Announcements 77(2):#PB-259 633/6GA. 1977]

C-0846-77
ERDA STUDIES WILL HELP ASSESS EFFECTS OF ENERGY GROWTH ON CONTINENTAL SHELF
Anon. 1976.
Information from ERDA July 16:5-6.

Offshore drilling, OCS, Atlantic coast, Environmental protection, Movement, Contaminants, *Southeastern U.S., ERDA

ERDA-sponsored research is gathering basic scientific information to protect the environment along the continental shelf of the U.S. southeastern coast by anticipating environmental problems that would result from offshore drilling and power plant construction. The movement of the Gulf Stream and the influence of it and winds on current patterns of the continental shelf will be studied in order to provide details about how nutrient and pollutants move aroung the shelf.

[from Energy Review No. 17:7. 1976]

C-0847-77

OFFSHORE OIL AND COASTAL RECREATION - COHABITATION OR CONFLICT

Anon. 1976.
OCS Update. Special June, 1976 issue. 8p.

Offshore development, Environmental effects, Oil industry, Oil spills, Environmental deterioration, Delaware, Government agencies, *Coastal recreation

This report summarizes divergent viewpoints expressed at a recent conference on the effects of offshore oil development on the environment, coastal recreation, and the related recreation industry. Opinions about the adverse effects of offshore development, the possibility of oil spillage and the resultant environmental degradation, and impacts on coastal recreation are expressed from the perspectives of the oil industry, recreation industry, and involved county, state and federal agencies.

C-0848-77

CIVIL LIABILITY FOR POLLUTION FROM OFFSHORE OPERATIONS

Archer, P., and C. A. Fleischer. 1976.
Environmental Policy & Law 2(1):2-5.

Offshore development, Liability, Europe, UK, France, Denmark, Norway, *Pollution damage

Disagreements arose between delegates from nine northwestern European countries regarding the extent of liability in the event of pollution damage caused by offshore operations. The U.K. and France favored a $25 million limit of liability for any one incident, and Norway and Denmark proposed a $60 million limit. The Norwegian view of strict and unlimited liability presently in force in Norway's sector of the North Sea is explained.

[from Environment Abstracts 6(9):#76-05816. 1976]

C-0849-77

OPERATIONS AND ENVIRONMENTAL CONSIDERATIONS, OCCIDENTAL PETROLEUM CORPORATION IN SITU OPERATIONS

Chow, R. T., III. 1976.
Science and Technology of Oil Shale. T. F. Yen (ed.). Ann Arbor, Michigan, Ann Arbor Science Publishers, Inc. 1976. p. 73-86.

Oil shale, Development, EIS, Colorado

Oil shale operations began at the Logan Wash Property near De Beque, Colorado, in June 1972. About half of the area, 1620 hectares (4000 acres) is underlain by oil shale. With respect to environmental considerations, the Logan Wash Project has two parallel thrusts: to acquire and prepare data for permit applications required for the operation, and to acquire baseline data needed to prepare a complete environmental impact statement for the project.

C-0850-77
ENVIRONMENTAL PROBLEMS ENCOUNTERED IN SHALE OIL PRODUCTION
Davidson, J. W. 1976.
Symposium on Alternate Fuels Resources, Santa Maria, California, 1976. North Hollywood, California, Western Periodicals Company; Vandenberg, California, American Institute of Aeronautics and Astronautics, Inc., 1976. p. 373-381.

Oil shale, Production, Extraction, Environmental effects, Solid waste, Wastewaters

Environmental control technologies applicable to shale oil production are reviewed, and the management of solid and liquid wastes from commercial extraction processes is discussed.

[from International Aerospace Abstracts 16(24):#A76-47313. 1976]

C-0851-77
ENVIRONMENTAL PROTECTION AGENCY'S ROLE, INTERESTS, AND RESPONSIBILITIES WITH RESPECT TO THE OUTER CONTINENTAL SHELF DEVELOPMENT
Davis, W. P. 1976.
Bureau of Land Management's Environmental Studies Program for the South Atlantic Outer Continental Shelf Area, Conference/Workshop Proceedings. M. F. Massuglia (compiler). Research Triangle Park, N. C., Research Triangle Institute, 1976. p. 55-58. Held at Atlanta, Georgia, 1976.

Offshore development, OCS, EPA, Environmental management, Oil spills, Water quality, Estuaries, Coasts

The EPA's role with respect to OCS development and environmentally sound management is outlined. The agency is concerned with ocean disposal and oil spillage, establishment of marine water quality standards, the effects of manmade organic compounds on the nearshore and estuarine environment, and maintenance of the U.S. coastal regions.

[from Selected Water Resources Abstracts 9(21):#W76-11470. 1976]

C-0852-77
THE VALUE OF OFFSHORE OIL
Dorfman, R. 1976.
The Question of Offshore Oil. E. J. Mitchell (ed.). Washington, D.C., American Enterprise Institute for Public Policy Research, 1976. p. 5-15.

Offshore development, Economics, Environmental effects

The author estimates that the oil and gas in the outer continental shelf was worth about $100 billion and concludes that these resources could make a significant contribution to the nation's fuel supply. The environmental costs of development would be great, but compared to coal and nuclear power, offshore resources would prove to be relatively clean environmentally.

C-0853-77
OFFSHORE OIL POTENTIAL AND LAND USE IMPACTS IN THE CENTRAL CALIFORNIA COASTAL ZONE
Doyle, W. T., (ed.). 1975.
University of California, Coastal Marine Studies, Special Publication No. 3. 88p.

Offshore drilling, Oil industry, Environmental effects, California coast, Onshore impacts

The oil potential of central and northern California, with particular interest in the Monterey Bay area, is considered and consequent possible land use conflicts are discussed. Offshore drilling impacts are also discussed.

[from Oceanic Abstracts 13(6):#76-05770. 1976]

C-0854-77
THE ENVIRONMENTAL AND SOCIO-ECONOMIC BASELINE ON THE GULF OF MEXICO COASTAL ZONE AND OUTER CONTINENTAL SHELF
Environmental Consultants Inc. 1975.
U.S. Bureau of Land Management. 3 volumes.

Offshore development, OCS, Coasts, Environmental effects, Socio-economic effects, Gulf of Mexico

Available from New Orleans OCS Office, Suite 3200, The Plaza Tower, 1001 Howard Ave., New Orleans, LA 70113.

[from Ocean Oil Weekly Report 10(18). 1975]

C-0855-77
ACCOMPLISHMENT PLAN, REGION VIII, COVERING EPA ACTIVITIES RELATING TO OIL SHALE (COLORADO, UTAH, WYOMING)
Environmental Protection Agency. 1974.
Report PB-255 125/7GA. 110p.

Oil shale, Development, EPA, *Rocky Mountain states

A description is given of the allocation of EPA resources to perform its responsibilities in light of major oil-shale development in these Rocky Mountain states.

[from Petroleum Abstracts 17(3):#229,167. 1977]

C-0856-77
SOUTHEAST COASTAL RESEARCH ACTIVITIES OF ERDA
Forster W. O. 1976.
Bureau of Land Management's Environmental Studies Program for the South Atlantic Outer Continental Shelf Area, Conference/Workshop Proceedings. M. F. Massoglia (compiler). Research Triangle Park, N.C., Research Triangle Institute, 1976. p. 29-37. Held at Atlanta, Georgia, 1975.

Offshore production, Atlantic coast, ERDA, Environmental effects, Oil discharges, Chronic effects

ERDA has developed a research program designed to complement that of the USBLM. The overall program is divided into the physical, geochemical, geological and biological programs, the purposes of which are discussed. The studies emphasize the potential environmental impacts of chronic petroleum discharges on the nearshore rather than thw offshore areas.

[from Selected Water Resources Abstracts 9(21):#W76-11477. 1976]

C-0857-77
ENVIRONMENTAL OIL SHALE SYMPOSIUM, PROCEEDINGS, 1975.
Gary, J. H. (ed.). 1975.
Quarterly of the Colorado School of Mines 70(4). 244p.

Oil shale, Development, Environmental effects, Extraction

Nineteen papers in this proceedings deal with aspects of environmental quality problems associated with oil shale extraction and processing. The range of topics extends from environmental baseline data aquisition to legislative attitudes in the respective states involved in oil shale exploration and development.

[from The Engineering Index Monthly 14(12):#082896. 1976]

C-0858-77
DECISIONS FOR DELAWARE: SEA GRANT LOOKS AT OCS DEVELOPMENT
Goodman, J. M. 1975.
Report DEL SG-1-75(1). 43p.

Offshore development, OCS, Environmental effects, Economic effects, Delaware, Atlantic Coast

This report presents information on potential effects of OCS petroleum development in the Mid-Atlantic region. The study includes quantitative predictions of environmental, econmic, and land-use impacts of oil-gas development, based in part on an analysis of similar development in the Gulf of Mexico and California coast.

[from Univeristy of Delaware Marine Publications Catalog. p. 6. Summer 1976]

C-0859-77
PRELIMINARY REPORT ON THE ENVIRONMENTAL GEOLOGY OF SELECTED AREAS OF THE SOUTHERN CALIFORNIA CONTINENTAL BORDERLAND
Green, H. G., S. H. Clark, Jr., M. E. Field, F. I. Linker, and H. L. Wagner. 1975.
U.S. Department of the Interior, Geological Survey. Open-file Report 75-596. 70p.

Offshore development, OCS, Southern California, Environmental effects, *Geologic hazards

Selected areas of the Southern California continental borderland have been studied to define the nature and extent of geologic hazards which could affect the environment as a result of the development of petroleum resources in this region. The areas designated for leasing in Federal Outer Continental Shelf lease sale 35 were studied in detail. The geologic phenomena investigated include faulting, seismicity, sediment instability, sediment erosion, and oil and gas seeps. Faulting and seismic activity are major hazards in all of the areas. Additional information is necessary for a complete evaluation of geologic hazards in the borderland region.

C-0860-77
OFFSHORE OPERATIONS, REGULATION, AND ENVIRONMENTAL PROTECTION: OPEN DISCUSSION
Hickman, R. R. 1975.
U.S. Bureau of Land Management Conference on Environmental Studies for the South Atlantic Continental Shelf Area, Atlanta, 1975. p. 63-76.

Offshore drilling, Offshore development, Environmental protection, Regulations, Alaska, Southern California, Gulf of Mexico

Environmental protection considerations and governmental regulation of offshore drilling and oil-gas development are discussed with reference to ongoing Exxon operations in the Gulf in Mexico, offshore Southern California, and Cook Inlet, Alaska.

[from Environment Abstracts 6(11):#76-07381. 1976]

C-0861-77
PROBLEMS ON ENVIRONMENTAL POLLUTION CAUSED BY THE PETROLEUM INDUSTRY
Hsieh, C.-H. 1976.
Neng Yuan Chi Kan 6(2):80-86.

Oil industry, Environmental effects, Contamination, Pollution control

"Environmental pollution caused by the petroleum industry and pollution control methods are reviewed."

[from Chemical Abstracts 86(4):#21111c. 1977]

C-0862-77
OFFSHORE OIL AND FISHERY RESOURCES
Jensen, A. C. 1976.
New York Fish and Game Journal 23(2):136-148.

Offshore drilling, Oil spills, Fisheries, Coasts, New York

Coastal fishery resources off the coast of New York are examined in view of offshore drilling and possible oil spills.

[from Biological Abstracts 62(12):#65749. 1976]

C-0863-77
ENVIRONMENTAL ASPECTS OF PRODUCED WATERS FROM OIL AND GAS EXTRACTION OPERATIONS IN OFFSHORE AND COASTAL WATERS
Koons, C. B., C. D. McAuliffe, and F. T. Weiss. 1976.
Offshore Technology Conference, 8th, Houston, Texas, 1976.
OTC Paper no. 2447. p. 247-257.

Environmental effects, Toxicity, Offshore production, Contamination, Marine organisms, *Produced waters

The constituents of produced waters and their marine environmental effects are examined. Laboratory and field studies show that toxic components occur in low concentrations in produced waters; natural processes such as dilution, evaporation, and chemical and biological reactions rapidly reduce contaminants to levels that are harmless to the marine environment and continuous low-level discharges of produced water have few or no detrimental effects on the marine environment or biota.

C-0864-77
SEA WATER POLLUTION AND ITS CONTROL DURING PETROLEUM EXPLORATION [in Chinese]
Liu, C.-F. 1975.
Shih You Tsuan T'sai Kung Ch'eng No. 15:192-200.

Exploration, Pollution control, Seawater

"A review with 10 references."

[from Chemical Abstracts 85(26):#197810y. 1976]

C-0865-77
BUREAU OF LAND MANAGEMENT'S ENVIRONMENTAL STUDIES PROGRAM FOR THE SOUTH ATLANTIC OUTER CONTINENTAL SHELF AREA, CONFERENCE/WORKSHOP PROCEEDINGS
Massoglia, M.F. (compiler). 1976.
Research Triangle Park, North Carolina, Research Triangle Institute, 1976. 283p. Held at Atlanta Georgia, 1975.

Offshore drilling, Environmental effects, OCS, Monitoring, Guidelines, Atlantic Ocean, BLM

The report is a compilation of papers and discussions of the title conference/workshop. Objectives of this meeting were to summarize available information on the South Atlantic OCS area; to identify subject areas in need of additional environmental study; to provide predictions on environmental effects of drilling, based on present information; and to formulate guidelines for further baseline and environmental monitoring studies for the South Atlantic OCS area

[from Selected Water Resources Abstracts 9(21):#W76-11474. 1976]

C-0866-77
ENVIRONMENTAL ASPECTS OF OCS PETROLEUM DEVELOPMENT
McAuliffe, C. D. 1976.
Los Angeles Council of Engineers and Scientists Proceedings Series No. 2, p.49-59. Energy LA: Tackling Crisis, Greater Los Angeles Area Energy Symposium, 1976.

Offshore development, Environmental effects, OCS

The environmental aspects of OCS petroleum development are reviewed.

[from Chemical Abstracts 85(22):166022p. 1976]

C-0867-77
THE ENVIRONMENTAL IMPACT OF OFFSHORE DRILLING
Menard, W. 1976.
The Question of Offshore Oil. E. J. Mitchell (ed.). Washington, D.C., American Enterprise Institute for Public Policy Research, 1976. p. 33-41.

Offshore drilling, Environmental effects, Oil spills

The author points out that constant changes in marine biology and ocean currents rapidly make environmental assessments of offshore areas out of date. Questions are raised concerning the immediate and long-term responses of the environment to oil spills. It is suggested that environmental impact be measured not in absolute terms but according to the actual exposure of people to environmental "insults".

C-0068-77
CONCLUSIONS AND RECOMMENDATIONS CONFERENCE/WORKSHOP
Menzel, D. 1976.
Bureau of Land Management's Environmental Studies Program for the South Atlantic Outer Continental Shelf Area, Conference/Workshop Proceedings. M. F. Massoglia (compiler). Research Triangle Park, N.C., Research Triangle Institute, 1976. p. 227-250. Held at Atlanta, Georgia, 1975.

Offshore development, OCS, Environmental effects, Hydrocarbons, Environmental deterioration, Health hazards, Atlantic Ocean

Study priorties for additional research into impacts of Southeastern Atlantic OCS development on man and the environment are summarized. Of major concern were 1) the possibility of accidents resulting from geologic hazards, 2) permanent destruction of unique environments; and 3) the effects of metals and hydrocarbons on organisms and man.

[from Selected Water Resources Abstracts 9(21):#W76-11485. 1976]

C-0069-77
OVERVIEW OF CONFERENCE PROGRAMS
Menzel, D. 1976.
Bureau of Land Management's Environmental Studies Program for the South Atlantic Outer Continental Shelf Area, Conference/Workshop Proceedings. M. F. Massoglia (compiler). Research Triangle Park, N. C., Research Triangle Institute, 1976. p. 93-96. Held at Atlanta, Georgia, 1975.

Offshore drilling, Environmental effects, Platforms, OCS, Atlantic Ocean, BLM

The objectives of the conference are reviewed; these include summarizing available information and understanding the southeast U.S. continental shelf environment, and predicting the environmental effects of oil drilling. The USBLM is specifically concerned with the environmental impacts of activities on and around drilling platforms.

[from Selected Water Resources Abstracts 9(21):#W76-11481. 1976]

C-0870-77
THE QUESTION OF OFFSHORE OIL
Mitchell, E. J. (ed.). 1976.
Washington, D. C.: American Enterprise Institute for Public Policy
Research, 1976. 161p.

Offshore development, Economics, Environmental effects, Offshore drilling

This conference held March 20-21, 1975, and sponsored by the American Enterprise Institute (AEI) National Energy Project, dealt with the subject of offshore oil - economic value and environmental risk. Four major papers were given: The Value of Offshore Oil (R. Dorfman); The Environmental Impact of Offshore Oil (W. Menard); The Social Benefit/Cost Analysis of Offshore Oil (W. Mead); and The Appropriate Pace of Offshore Offshore Drilling (I. White). Each paper was followed by comments from discussants. The conference concluded with a Round Table Discussion on Offshore Oil: Costs and Benefits.

C-0871-77
THE OFFSHORE ECOLOGY INVESTIGATION: AN EVALUATION OF OIL INDUSTRY IMPACT ON CENTRAL COASTAL LOUISIANA
Morgan, J. P. 1975.
Gulf Association of Geological Societies, Transactions Vol. 25.
p. 182. Abstract.

Offshore production, Oil industry, Environmental effects, Hydrocarbons, *Marine organisms, Sediments, Louisiana

A study conducted by the Gulf Universities Research Consortium on the environmental effects of offshore exploration, drilling, and production off the Louisiana coast is presented. No significant ecological changes were noted; hydrocarbon levels in organisms, the water column, and sediments were low and present no known biological hazards. The reef effect of platform structures tends to increase biological activity.

C-0872-77

ENVIRONMENTAL IMPROVEMENTS BY OIL SHALE LEACHING

Moussavi, M., and T. F. Yen. 1976.
Science and Technology of Oil Shale. T. F. Yen (ed.). Ann Arbor, Michigan, Ann Arbor Science Publishers Inc., 1976. p. 205-220.

Oil shale, Development, Environmental effects, *Liquid wastes, Solid wastes, *Leaching

"The effect of minerals leaching prior to retorting of any other processes utilized for recovery of organics from oil shales is multifunctional. A considerable decrease in required retorting temperature may be obtained by leaching." ..."The volume of liquid and solid wastes left behind by shale oil industries is considerably high. If the leaching step is taken, it will become higher. However, since the nature of waste is environmentally more refractive, it is preferred."

C-0873-77

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF: VOLUME 1. MARINE MAMMALS

National Oceanic and Atmospheric Administration, Environmental Research Laboratories. 1976.
NOAA, Environmental Research Laboratories, Principal Investigators' Reports for the Year Ending March 1976. 434p.

Environmental effects, Offshore development, Alaska, OCS, Marine mammals, *Baseline studies

Baseline studies on the abundance, diversity, characteristics and distribution of marine mammals of the Alaskan Continental Shelf are presented as part of a 14-volume assessment of the environmental effects of OCS resources development and oil pollution.

[From Selected Water Resources Abstracts 10(2):#W77-00901. 1977]

C-0874-77

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. VOLUME 2. MARINE BIRDS

National Oceanic and Atmospheric Administration, Environmental Research Laboratories. 1976.
NOAA, Environmental Research Laboratories, Principal Investigators' Reports for the Year Ending March 1976. 601p.

Environmental effects, Offshore development, Alaska, OCS, Birds, *Baseline studies, *Marine birds

Studies on the coastal and seabirds of the Alaskan Continental Shelf are presented as part of a 14-volume assessment of the environmental effects of Alaskan OCS resources development and oil pollution. Included are reports on the abundance, diversity, behavioral characteristics, and distribution of seabirds, their habitats, migratory routes, breeding habits, and their interrelationships with the environment.

[From Selected Water Resources Abstracts 10(2):#W77-00902. 1977]

C-0875-77
ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF.
VOLUME 3. MARINE BIRDS
National Oceanic and Atmospheric Administration, Environmental
Research Laboratories. 1976.
NOAA, Environmental Research Laboratories, Principal Investigators'
Reports for the Year Ending March 1976. 647p.

Environmental effects, Offshore development, Alaska, OCS, Birds,
*Baseline studies, *Marine birds

Studies on the behavior, abundance, feeding ecology, and seasonal distribution of seabirds of the Alaskan Continental Shelf waters are presented as part of a 14-volume assessment of the environmental effects of Alaskan OCS resources development and oil pollution.

[from Selected Water Resources Abstracts 10(2):#W77-00903. 1977]

C-0876-77
ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF.
VOLUME 4. MARINE BIRDS
National Oceanic and Atmospheric Administration, Environmental
Research Laboratories. 1976.
NOAA, Environmental Research Laboratories, Principal Investigators'
Reports for the Year Ending March 1976. 362p.

Environmental effects, Offshore development, Alaska, OCS, Birds,
*Baseline studies, *Marine birds

Among the topics of this volume are: results of aerial surveys and photographic mapping of seabirds and seabird colonies; literature reviews; and analyses of published and unpublished data on seabird migratory patterns, population dynamics, and habitats. These reports are part of a 14-volume assessment of the environmental effects of OCS resources development and oil pollution.

[from Selected Water Resources Abstracts 10(2):#W77-00904. 1977]

C-0877-77
ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF.
VOLUME 5. FISH, PLANKTON, BENTHOS, LITTORAL
National Oceanic and Atmospheric Administration, Environmental
Research Laboratories. 1976.
NOAA, Environmental Research Laboratories, Principal Investigators'
Reports for the Year Ending March 1976. 715p.

Environmental effects, Offshore development, Alaska, OCS, Benthos,
Marine organisms, Beaufort Sea, Bering Sea, *Baseline studies

Included in this volume are studies on the abundance, distribution, diversity and productivity of benthic organisms of the Bering and Beaufort Seas, and summaries of the published and unpublished literature on benthic organisms of the Beaufort Sea. The volume is part of a 14-volume assessment of the environmental effects of Alaskan OCS resources development and oil pollution.

[from Selected Water Resources Abstracts 10(2):#W77-00905. 1977]

C-0878-77
ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF.
VOLUME 6. FISH, PLANKTON, BENTHOS, LITTORAL
National Oceanic and Atmospheric Administration, Environmental
Research Laboratories. 1976.
NOAA, Environmental Research Laboratories, Principal Investigators'
Reports for the Year Ending March 1976. 687p.

Environmental effects, Offshore development, Alaska, OCS, Fish, Mollusks, Habitat, *Baseline studies

Baseline studies and surveys of specific fishes and mollusks and their habitats, productivity, abundance, and spawning characteristics are presented as part of a 14-volume assessment of the environmental effects of Alaskan OCS resources development and oil pollution.

[from Selected Water Resources Abstracts 10(2):#W77-00906. 1977]

C-0879-77
ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF.
VOLUME 7. FISH, PLANKTON, BENTHOS, LITTORAL
National Oceanic and Atmoshperic Administration, Environmental
Research Laboratories. 1976.
NOAA, Environmental Research Laboratories, Principal Investigators'
Reports for the Year Ending March 1976. 675p.

Environmental effects, Offshore development, Alaska, OCS, Plankton, Benthos, Fisheries, *Baseline studies

Among the baseline studies presented in this volume are reports on phytoplankton and zooplankton of the continental shelf areas surrounding Alaska; fisheries and other demersal resources; and literature reviews on distribution, abundance, diversity and productivity of benthic organisms of the Gulf of Alaska, Bering Sea and Beaufort Sea. This study is part of a 14-volume assessment of the environmental effects of Alaskan OCS resources development and oil pollution.

[from Selected Water Resources Abstracts 10(2):#W77-00907. 1977]

C-0880-77
ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF.
VOLUME 8. EFFECTS OF CONTAMINANTS
National Oceanic and Atmospheric Administration, Environmental
Research Laboratories. 1976.
NOAA, Environmental Research Laboratories, Principal Investigators'
Reports for the Year Ending March 1976. 382p.

Offshore development, Environmental effects, Biological effects, Alaska, OCS, Hydrocarbons, Marine organisms, Biodegradation

Among the reports presented in this volume are studies on the acute and chronic effects of petroleum hydrocarbons on the marine biota and on specific fishes, marine mammals and crustaceans; uptake, depuration and sublethal effects of petroleum and petroleum hydrocarbons on organisms as reflected in morphological, physiological, chemical and behavioral changes; biodegradation and biotransformation of petroleum compounds; and literature reviews of biological effects of oil on the arctic and subarctic biota.

[from Selected Water Resources Abstracts 10(2):#W77-00908. 1977]

C-0881-77
ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF
VOLUME 9. CHEMISTRY AND MICROBIOLOGY
National Oceanic and Atmospheric Administration, Environmental
Research Laboratories. 1976.
NOAA, Environmental Research Laboratories, Principal Investigators'
Reports for the Year Ending March 1976. 655p.

Environmental effects, Offshore development, Alaska, OCS, Microorganisms, Hydrocarbons, Chemical analysis, Distribution, *Baseline studies

Included in this volume are studies on the analysis of trace hydrocarbons, their abundance and distribution; and the interaction of microorganisms and petroleum pollutants in the Beaufort Sea and Gulf of Alaska. The volume is part of a 14-volume assessment of the environmental effects of Alaskan OCS resources development and oil pollution.

[from Selected Water Resources Abstracts 10(2):#W77-00909. 1977]

C-0882-77
ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF.
VOLUME 10. CHEMISTRY AND MICROBIOLOGY
National Oceanic and Atmoshperic Administration, Environmental
Research Laboratories. 1976.
NOAA, Environmental Research Laboratories, Principal Investigators'
Reports for the Year Ending March 1976. 436p.

Environmental effects, Offshore development, Alrska, OCS, Biodegradation, Hydrocarbons, Distribution, *Baseline studies

Among the reports presented in this volume are studies of crude oil degradation by psychrophilic bacteria; baseline assessment of microbial activity in the Beaufort Sea and Gulf of Alaska; natural hydrocarbon distribution and dynamics of the Alaskan OCS area; and the microbial release of soluble trace metals from oiled sediments. These reports are part of a 14-volume assessment of the environmental effects of Alaskan OCS resources development and oil pollution.

[from Selected Water Resources Abstrccts 10(2):#W77-00910. 1977]

C-0883-77
ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF.
VOLUME 11. PHYSICAL OCEANOGRAPHY AND METEOROLOGY
National Oceanic and Atmospheric Administration, Environmental
Research Laboratories. 1976.
NOAA, Environmental Research Laboratories, Principal Investigators'
Reports for the Year Ending March 1976. 998p.

Environmental effects, Offshore development, Alaska, OCS, *Baseline studies, *Physical oceanography, *Meteorology

This volume presents reports dealing mostly with the physical oceanography of the Gulf of Alaska, Beaufort Sea, and Bering Sea. Included are topics on oceanographic processes, coastal and ocean currents, transport of pollutants, regional marine climatology, development and application of current mapping, analytical models, and historical and statistical data analyses. These studies are part of a 14-volume assessment of the environmental effects of Alaskan OCS resources development and oil pollution.

[from Selected Water Resources Abstracts 10(2):#77-00911. 1977]

C-0884-77
ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF.
VOLUME 12. GEOLOGY
National Oceanic and Atmospheric Administration, Environmental
Research Laboratories. 1976.
NOAA, Environmental Research Laboratories, Principal Investigators'
Reports for the Year Ending March 1976. 679p.

Environmental effects, Offshore development, Alaska, OCS, *Baseline studies, *Geologic hazards, *Marine geology

Geologic studies constitute this part of a 14-volume assessment of the environmental effects of Alaskan OCS resources development and oil pollution. Research reports on seismic and volcanic hazards, sedimentation, coastal morphology, regional environmental geology and geomorphology, offshore permafrost and marine geology problems are presented.

[from Selected Water Resources Abstracts 10(2):#W77-00912. 1977]

C-0885-77
ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF.
VOLUME 13. GEOLOGY
National Oceanic and Atmospheric Administration, Environmental
Research Laboratories. 1976.
NOAA, Environmental Research Laboratories, Principal Investigators'
Reports for the Year Ending March 1976. 430p.

Environmental effects, Offshore development, Alaska, OCS, *Baseline studies, *Geologic hazards

Geologic processes and geologic hazards of the Alaskan Continental Shelf are discussed in this part of a 14-volume assessment of the environmental effects of Alaskan OCS resources development and oil pollution. Research reports on recent and active faulting, slope instabilities, slumping, submarine and coastal depositional and erosional processes, seismic and volcanic risks, and coastal and offshore permafrost are presented.

[from Selected Water Resources Abstracts 10(2):#W77-00913. 1977]

C-0086-77
ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF.
VOLUME 14. ICE
National Oceanic and Atmospheric Administration, Environmental
Research Laboratories. 1976.
NOAA, Environmental Research Laboratories, Principal Investigators'
Reports for the Year Ending March 1976. 469p.

Environmental effects, Offshore development, Alaska, OCS, Ice,
Arctic Ocean, *Baseline studies

Among the topics covered in this volume are: the interactions of oil with sea ice in the Arctic Ocean; the morphology and dynamics of sea ice, the seasonal development, abundance and decay of sea ice, the study of sea ice conditions by aerial and satellite remote sensing; historical baseline ice studies; and development of equipment and methods for sea ice measurement and monitoring. These studies are part of a 14-volume assessment of the environmental effects of Alaskan OCS resources development and oil pollution.

[from Selected Water Resources Abstracts 10(2):#W77-00914. 1977]

C-0087-77
INTRODUCTION
Pearman, A. L. 1975.
Florida Coastal Policy Study: The Impact of Offshore Oil Development.
A. L. Pearman and J. W. Stafford (eds.). Florida State University,
and University of South Florida, 1975 (reprinted 1976). Chapter I.
p. 1-30. Final report.

Offshore exploration, Offshore development, Socio-economic effects,
Onshore impacts, Florida

The patterns of development and onshore impacts of OCS oil-gas exploration and development are discussed, using examples from other Gulf states and the British experience with North Sea production. The social and economic effects on coastal communities are considered, and the development of the inland Florida Jay oil field is briefly reviewed.

C-0888-77
FLORIDA COASTAL POLICY STUDY: THE IMPACT OF OFFSHORE OIL DEVELOPMENT
Pearman, A. L., and J. W. Stafford. 1975.
Florida State University, and University of South Florida, 1975 (reprinted 1976). ix + 273p. Final report.

Offshore development, Environmental effects, Onshore impacts, Socio-economic effects, Refineries, Ports, Coasts, Florida, Guidelines

In chapters I to IX, the environmental, economic, social and legal effects of offshore oil-gas development and related oil production and transfer facilities on coastal Florida are examined, based on an analysis of oil-gas development in other coastal areas. In the last chapter, policy options are identified and developed to serve as guidelines for minimizing the adverse offshore and onshore impacts of such activities.

C-0889-77
GEOLOGICAL OCEANOGRAPHY CONSIDERATIONS
Pilkey, O. H. 1976.
Bureau of Land Management's Environmental Studies Program for the South Atlantic Outer Continental Shelf Area, Conference/Workshop Proceedings. M. F. Mussoglia (compiler). Research Triangle Park, N.C., Research Triangle Institute, 1976. p. 97-101. Held at Atlanta, Georgia, 1975.

OCS, Atlantic Ocean, EIS, *Geologic framework

A brief overview of the geologic framework of the southeastern U.S. Continental Shelf is presented, and problems to be investigated in conjunction with other baseline environmental studies are identified and listed.

[from Selected Water Resources Abstracts 9(21):#W76-11402. 1976]

C-0890-77
OIL UNDER THE ICE
Pimlott, D., D. Brown, and K. Sam. 1976.
Ottawa, Ontario, Canadian Arctic Resources Committee, 1976. 161p.

Offshore drilling, Arctic, Environmental effects, Beaufort Sea, Canada

The book is a thorough case-study of the environmental risks of drilling programs which have already been undertaken from areas of the Canadian Arctic and which have been proposed for deeper waters of the Beaufort Sea and Lancaster Sound. Evidence is presented of the need for a clearly stated policy of environmental assessment and public review of development plans in hazardous areas.

C-0891-77
NOAA RESEARCH ON MARINE ENVIRONMENTAL EFFECTS OF ENERGY-RELATED ACTIVITIES
Rucker, J. B. 1976.
EPA National Conference on Health, Environmental Effects, and Control Technology of Energy Use, Washington, D. C., 1976. 4p.

Offshore development, Environmental effects, Puget Sound, Gulf of Mexico, Fate, Hydrocarbons, Toxicity, Marine organisms, NOAA

The following NOAA energy-related R&D projects are described: an environmental assessment of the potential impact of petroleum activities in Northern Puget Sound and Strait of Juan de Fuca; an environmental assessment of an active oil field in the northwestern Gulf of Mexico; and a study of the fate and effects of toxic metals and petroleum hydrocarbons on selected ecosystems and organisms.

[from Environment Abstracts 6(9):#76-05861. 1976]

C-0892-77
SHETLAND'S OIL- AND SHETLAND'S ENVIRONMENT
Sage, B. 1976.
New Scientist 70(998):236-238.

Development, Pipelines, Storage, Oil industry, Scotland, *Sullom Voe terminal

Handling by Shetland authorities of the adverse impacts of oil development at the Sullom Voe pipeline terminal, oil storage, and transmission facilities is described.

[from Environment Abstracts 6(9):#76-05783. 1976]

C-0893-77
AN OIL SPILL RISK ANALYSIS FOR THE SOUTH ATLANTIC OUTER CONTINENTAL SHELF LEASE AREA
Slack, J. R., and R. A. Smith. 1976.
U.S. Geological Survey Open-file report, No. 76-653. 58p.

Oil spills, OCS, Oil-gas leasing, Fate, Environmental effects, Atlantic Ocean, *Risk analysis

The study was conducted to yield estimates of the overall oil spill risk associated with development of the Atlantic OCS lease area. Analyzed were probability of spill occurrence, likely path of pollutants from spills, and locations in space and time of recreational and biological resources likely to be vulnerable.

[from Petroleum Abstracts 17(8):#230,631. 1977]

C-0894-77
IMPACT ANALYSIS OIL PLATFORM CONSTRUCTION AT LOCH CARRON
Sphere Environmental Consultants Ltd. n.d.
Report. 197p.

Platforms, Development, EIS, Environmental effects, Scotland

The report was prepared for the Scottish Development Department in connection with environmental impacts of the proposed construction of concrete wellhead platforms at a site at Loch Carron.

[from Offshore Abstracts 3(5):#76-1985. 1976]

C-0895-77
ENVIRONMENTAL IMPACTS OF OCS OIL AND GAS ACTIVITY
Stafford, J. W. 1975.
Florida Coastal Policy Study: The Impact of Offshore Oil Development. A. L. Pearman and J. W. Stafford (eds.). Florida State University, and University of South Florida, 1975 (reprinted 1976). Chapter VI. p. 131-162. Final report.

Offshore development, Environmental effects, OCS, Oil spills, Pipelines, Florida

A general overview is presented of a range of environmental impacts associated with OCS oil and gas exploration, drilling, development, production, storage, transport, and processing. Whereas the pollution associated with geophysical exploration in Florida waters has usually been negligible, drilling rigs, production platforms, pipelines, and transfer and storage facilities present a more serious environmental threat in the form of potential blowouts, large oil spills, and small or chronic spills and discharges.

C-0896-77
OIL ON EAST COAST GROUNDS - HOW BAD IS BAD? (news brief)
Townes, B. 1977.
National Fisherman 57(9):78.

Oil spills, Offshore development, Fisheries, Economic effects, Atlantic Coast

The chances of a major oil spill occurring off New England's coast due to offshore oil development are discussed; the effects on fisheries, the fishing industry, and the economy are assessed.

C-0897-77
DRILLING, TANKERS AND OIL SPILLS ON THE ATLANTIC OUTER CONTINENTAL SHELF
Travers, W. B., and P. R. Luney. 1976.
Science 194(4267):791-796.

Offshore drilling, Blowout prevention, OCS, Tankers, Oil transport, Oil spills, Atlantic coast, California coast, Gulf of Mexico

Recent technological advances which prevent offshore oil well blowouts under adverse geologic conditions are explained, and the relatively safe geologic conditions of the Atlantic OCS areas are compared with those of the Gulf of Mexico and California. Sources of oil spills into the oceans are analyzed and tabulated. It is concluded that oil tankers and the long-distance transport of oil represent a far greater threat to the marine environment than offshore drilling and production.

C-0898-77
SEDIMENTS, STRUCTURAL FRAMEWORK, PETROLEUM POTENTIAL, ENVIRONMENTAL CONDITIONS, AND OPERATIONAL CONSIDERATIONS OF THE UNITED STATES SOUTH ATLANTIC OUTER CONTINENTAL SHELF
U.S. Geological Survey.
Open-file report 75-411. 262p.

Offshore development, Atlantic Ocean, OCS, Environmental effects

Summary not available. FFI contact Library, U.S. Geological Survey, National Center, Reston, VA 22092.

[from Marine Newsletter 7(3):8. 1976]

C-0899-77
A SOCIO-ECONOMIC ENVIRONMENTAL BASELINE SUMMARY FOR THE SOUTH ATLANTIC REGION BETWEEN CAPE HATTERAS, NORTH CAROLINA AND CAPE CANAVERAL, FLORIDA
Virginia Institute of Marine Science. 1975.
U.S. Bureau of Land Management. 5 volumes.

Offshore development, Socio-economic effects, Environmental effects, Atlantic Ocean

Available from New Orleans OCS Office, Suite 1700, The Plaza Tower, 1001 Howard Ave., New Orleans, LA 70113.

[from Ocean Oil Weekly Report 10(18). 1975]

C-0900-77
OIL AND ICE IN THE BEAUFORT SEA
Wadhams, P. 1976.
Polar Record 18(114):237-250.

Blowout prevention, Pollution control, Offshore drilling, Arctic, Beaufort Sea

The results of experimental and field studies of the Beaufort Sea have been published in 30 technical and 6 overview reports which are tabulated in this article. The most likely source of oil pollution is a well blowout and no adequate cleanup technique is presently available, especially if the oil becomes incorporated into the ice. Emphasis is placed, therefore, on the observation of very stringent safety precautions to prevent blowouts.

[from Petroleum Abstracts 17(1):#220,673. 1977]

C-0901-77
ENVIRONMENTAL PROBLEMS ASSOCIATED WITH ARCTIC DEVELOPMENT ESPECIALLY IN ALASKA
West G. C. 1976.
Environmental Conservation 3(3):218-224.

Exploration, Production, Arctic, Environmental effects, Plants, Wildlife, Oil spills, Marine organisms

The potentially adverse impacts on the environment, wildlife, and human health and safety resulting from exploration and production of mineral and petroleum resources in arctic environments are outlined. A brief discussion of the effects of oil spillage, especially in the aquatic environment, is included.

C-0902-77
THE DEPARTMENT OF THE INTERIOR'S OUTER CONTINENTAL SHELF LEASING PROGRAM
Whelan, J. 1976.
Bureau of Land Management's Environmental Studies Program for the South Atlantic Outer Continental Shelf Area, Conference/Workshop Proceedings. M. F. Massoglia (compiler). Research Triangle Park, N.C.: Research Triangle Institute, 1976. p. 11-14. Held at Atlanta,Georgia, 1975.

Oil-gas leasing, OCS, Offshore development, Economics, Environmental protection, USDI

USDI responsibilities in developing and managing OCS oil and mineral resources are outlined. They include the orderly development of such resources, receipt of fair market value for the leased mineral resources, and protection of the marine coastal environment.

[from Selected Water Resources Abstracts 9(21):#W76-11475. 1976]

C-0903-77
FEDERALLY SPONSORED OCS SCIENTIFIC STUDIES: PUBLIC RELATIONS OR ENVIRONMENTAL PROTECTION?: OPEN DISCUSSION
Winchester, E. 1975.
Bureau of Land Management's Environmental Studies Program for the South Atlantic Outer Continental Shelf Area, Conference/Workshop Proceedings. M. F. Massoglia (compiler). Research Triangle Park, N.C., Research Triangle Institute, 1976. p. 79-90. Held at Atlanta, Georgia, 1975.

Oil-gas leasing, EIS, Environmental protection, OCS, BLM

The presentation raises doubts over the real purposes and effectiveness of BLM and other federally sponsored environmental impact studies of possible OCS lease areas, and questions the adequacy of oil-gas leasing decisions based on one-year environmental assessment studies.

[From Environment Abstracts 6(11):#76-07382. 1976]

C-0904-77
THE ALASKAN OUTER CONTINENTAL SHELF ENVIRONMENTAL ASSESSMENT PROGRAM
Wolfe, D. A. 1975.
Bureau of Land Management's Environmental Studies Program for the South Atlantic Outer Continental Shelf Area, Conference/Workshop Proceedings. M. F. Massoglia (compiler). Research Triangle Park, N.C., Research Triangle Institute, 1976. p. 39-52. Held at Atlanta, Georgia, 1975.

Offshore development, Environmental effects, OCS, Alaska, Biological effects, Contaminants, Monitoring, Information Systems

NOAA's research program to assess the environmental impacts of Alaskan OCS oil and gas development is described. Research objectives include: characterization and quantification of petroleum-related contaminant and their effects on critical habitats, species, and biological processes; identification and quantification of irreversible effects; development of a pollution monitoring program; and the establishment of an environmental data storage and retrieval bank to provide an information base for all phases of OCS leasing and operation.

[From Environment Abstracts 6(11):#76-07380. 1976]

C-0005-77
FINAL ENVIRONMENTAL IMPACT REPORT FOR RESUMPTION OF DRILLING IN THE SANTA BARBARA CHANNEL FROM EXISTING STANDARD OIL COMPANY OF CALIFORNIA PLATFORMS
Woodward-Clyde Consultants. 1976.
Special report. 113 p.

Offshore drilling, Environmental effects, EIS, Santa Barbara Channel, *Air quality impacts

Presented are revisions to the Draft Environmental Impact Report of the title study. The most significant revisions deal with air quality baseline and potential impacts. Questions and comments from agencies and individuals during the public review of the Draft EIR and the public hearing held in Santa Barbara on May 8, 1976, are provided. Responses to questions and comments follow each statement.

[from Energy Information Abstracts 1(5): #76-23737. 1976]

E. FATE OF OIL IN THE ENVIRONMENT

1. BIODEGRADATION

C-0906-77
MICROBIAL DEGRADATION OF PETROLEUM IN THE ARCTIC
Atlas, R. M., and M. Busdosh. 1976.
Proceedings of the Third International Biodegradation Symposium. J. M. Sharpley and A. M. Kaplan (eds.). Barking, Essex, Applied Science Publishers, Ltd., 1976. p. 79-86. Symposium held in Kingston, Rhode Island, 17-23 August, 1975.

Biodegradation, Crude oil, Microorganisms, Arctic, Alaska

The effects of nutrient concentration, temperature, crude oil chemical composition, and concentration of oil-degrading microorganisms on the biodegradation of oil in Alaskan coastal waters were investigated. Addition of N and P or seeding with petroleum-degrading bacteria increased the rate of degradation in some situations.

[from Proceedings of the Third Biodegradation Symposium. List of Contents. Applied Science Publishers, Ltd. July, 1976]

C-0907-77
MICROBIAL DEGRADATION OF PETROLEUM
Azarowicz, E. N. 1976.
South African Patent 75 05,088

Biodegradation, Oil spills, Waste oil, Microorganisms, Patent, South Africa

A process for the microbial degradation of oil spills and oily wastes is described.

[from Petroleum Abstracts 17(5): #229,881. 1977]

C-0908-77
BIODEGRADATION OF OIL SLICKS ON THE MARINE ENVIRONMENT
Bartha, R. 1976.
Final report, Contract N00014-67-A-0115-0005. 11 p.

Biodegradation, Oil slicks, Hydrocarbons, Bacteria, Clean-up, *Nutrient enrichment

Biodegradation of petroleum hydrocarbons by marine bacteria was studied with the aim of using bacteria in oil spill cleanup operations. By supplying nitrogen, phosphorus, and iron to an oil slick, the rate of biodegradation can be increased by an order of magnitude or more.

[from Government Reports Announcements 77(1): #AD-A031 739/6GA. 1977]

C-0909-77
AEROBIC DEGRADATION OF HYDROCARBONS IN SOIL. SIGNIFICANCE OF AN INITIAL RISE IN OXYGEN UPTAKE RATE FOLLOWING CONTAMINATION WITH OIL
Blakebrough, N., P. J. Garner, A. H. Knap, J. M. Raisbeck, and D. Heppell. 1976.
Journal of Applied Chemistry and Biotechnology 26(10):550-558.

Biodegradation, Hydrocarbons, Soil, Oxidation, Microorganisms, *Oxygen uptake rate

The increase in the rate of oxygen uptake by the soil due to hydrocarbon addition was investigated using an electrolytic respirometer. Oxidation was not the cause of the increased rate but was probably due to microbial lysis or the release of nutrients induced by addition of the oil.

[from Petroleum Abstracts 17(6): #229,092. 1977]

C-0910-77
MICROBIAL GENETIC ENGINEERING. AN EVALUATION OF BENEFITS AND BIOHAZARDS
Chakrabarty, A. M. 1977.
Genetic Engineering. Cleveland, CRC Press Inc., 1977. 23 p.

Biodegradation, Oil spills, Bacteria, Cleanup, *Microbial genetic engineering

Three areas of genetic engineering research are discussed by the author: oil spill cleanup, enhanced production of methane from cellulosic wastes, and functional expression of bacterial nitrogen fixation genes in plants. The reasons for the genetic development of a multi-plasmid pure culture for oil spill cleanup, the methods used, and an assessment of biohazard potentials in using these microorganisms for this purpose are presented in Section I.

C-0911-77
HYDROCARBON-USING MICROORGANISMS IN THREE FRESH-WATER ECOSYSTEMS
Cooney, J. J., and R. J. Summers. 1976.
Proceedings of the Third International Biodegradation Symposium. J. M. Sharpley and A. M. Kaplan (eds.). Barking, Essex, Applied Science Publishers, Ltd., 1976. p. 141-156. Symposium held in Kingston, Rhode Island, 17-23 August, 1975.

Biodegradation, hydrocarbons, Microorganisms, Freshwater, Ecosystems

Both bacteria, and yeast and fungi are important in hydrocarbon polluted ecosystems. Only 0.1% of the total population grew with hydrocarbons as a sole carbon source. Representative colonies included 54% bacteria, 33% yeasts and 13% filamentous fungi; approximately 30% of each group was able to emulsify kerosene.

[from Proceedings of the Third International Biodegradation Symposium. List of Contents. Applied Science Publishers, Ltd. July, 1976]

C-0912-77
ACTIVITY OF SOIL BACTERIA ON PETROLEUM WASTE ADJACENT TO AN ACTIVE OIL WELL
Cooper, R. E., and H. G. Hedrick. 1976.
Soil Science 122(6):331-338.

Biodegradation, Waste oil, Oil wells, Bacteria, Soil,
*Petroleum waste

Of 10 primary isolatus, four bacteria were found to be highly active on petroleum waste and were identified as species of *Pseudomonas*, *Alcaligenus*, and *Achromobacter*. Results of growth experiments showed that all four isolates utilized petroleum waste at high rates in a shake-culture system. Studies on gaseous evolution showed a constant rate of activity as measured by evolved CO_2. Manometric studies showed a slow to moderate rate of oxygen uptake on three selected hydrocarbons.

[from Petroleum Abstracts 17(8): #230,634. 1977]

C-0913-77
SUPERSTRAIN OF OIL-EATING MICROBES
Cottrell, K. 1977.
Sea Frontiers 23(1):28-31.

Biodegradation, Hydrocarbons, Oil slicks, Bacteria,
*Supermicrobes

The article discusses the development of a new bacterial strain having the genetic capacity to breakdown simultaneously a variety of oil components. Dr. A. M. Chakrabarty, General Electric Research and Development Center, has combined the genetic makeup of four different strains of hydrocarbonoclastic bacteria that occur in nature into a single superstrain which is able to consume about two-thirds of the hydrocarbons in a crude oil slick.

C-0914-77

THE FATE OF PETROLEUM IN A SOIL ENVIRONMENT

Cresswell, L. W. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 479-482. (American Petroleum Institute No. 4284).

Biodegradation, Oil spills, Soil, Fate, Environmental effects

The fate of oil spilled on soil was studied by experimentally oiling test plots of land, tilling the oil into the top 15-20 cm of soil, and adding fertilizer for nutrients. Paraffinic crudes are found to biodegrade more rapidly than asphaltic crudes; at an oil concentration in soil of 5%, about 60 bbl/acre are degraded annually. No known adverse environmental effects have been observed after over 40 months; the oil appears to stay tightly bound in the top layer of soil, and apparently healthy crops of wheat have been grown in plots with 5-10% oil.

C-0915-77

MICROBIAL POPULATIONS IN COASTAL SURFACE SLICKS

Crow, S. A., W. L. Cook, D. G. Ahearn, and A. W. Bourquin. 1976.
Proceedings of the Third International Biodegradation Symposium. J. M. Sharpley and A. M. Kaplan (eds.). Barking, Essex, Applied Science Publishers, Ltd., 1976. p. 93-98. Symposium held in Kingston, Rhode Island, 17-23 August, 1975.

Biodegradation, Hydrocarbons, Bacteria, Oil slicks, Coasts, Freshwater

Bacterial concentrations on the surface were 10 to 100 times greater than these 10 cm below. The surface film bacteria had weak hydrocarbonoclastic and lipolytic activities. A greater proportion of them are capable of growth on freshwater media.

[from Proceedings of the Third International Biodegradation Symposium. List of Contents. Applied Science Publishers, Ltd. July, 1976]

C-0916-77
PSYCHROPHILIC HYDROCARBON-DEGRADING BACTERIA FROM
NARRAGANSETT BAY, RHODE ISLAND, U.S.A.
Cundell, A. M., and R. W. Traxler. 1976.
Material und Organismen 11(1):1-17.

Biodegradation, Hydrocarbons, Bacteria, Sediments, Seawater, Narragansett Bay, Rhode Island

Growth rates and generation times were reported for hydrocarbon degrading bacteria isolated by enrichment culture from littoral sediments and seawater collected in Narragansett Bay.

[from Biological Abstracts 63(1): #169. 1977]

C-0917-77
THE MICROBIAL METABOLISM OF CYCLOHEXANE AND RELATED COMPOUNDS
Donoghue, N. A., M. Griffin, D. B. Norris, and P. W. Trudgill. 1976.
Proceedings of the Third International Biodegradation Symposium.
J. M. Sharpley and A. M. Kaplan (eds.). Barking, Essex,
Applied Science Publishers, Ltd., 1976. p. 43-56. Symposium
held in Kingston, Rhode Island, 17-23 August, 1975.

Biodegradation, Hydrocarbons, Metabolism, Bacteria, *Alicyclic Compounds

Three genera of bacteria have been isolated which are capable of growth with cyclohexanol and cyclopentanol. The steps in the breakdown of these alicyclic hydrocarbons are presented.

[from Proceedings of the Third International Biodegradation Symposium. List of Contents. Applied Science Publishers, Ltd. 1976]

C-0918-77
RESEARCH ON THE FOULING BIOCENOSIS COMPOSITION IN RECYCLING
WATER SYSTEMS OF PETROLEUM PLANTS AND MEASURES TO COMBAT IT
Dzhalilov, R. K., N. I. Karayeva, and N. R. Magerramova. 1976.
Proceedings of the Third International Biodegradation
Symposium. J. M. Sharpley and A. M. Kaplan (eds.). Barking,
Essex, Applied Science Publishers, Ltd., 1976. p. 113-118.
Symposium held in Kingston, Rhode Island, 17-23 August, 1975.

Biodegradation, Wastewaters, Refineries, Recycling

Summary not available.

[from Proceedings of the Third International Biodegradation Symposium. List of Contents. Applied Science Publishers, Ltd. July, 1976]

C-0919-77
OIL BIODEGRADATION IN THE OCEANS
Floodgate, G. D. 1976.
Proceedings of the Third International Biodegradation Symposium. J. M. Sharpley and A. M. Kaplan (eds.). Barking, Essex, Applied Science Publishers, Ltd., 1976. p. 87-92. Symposium held in Kingston, Rhode Island, 17-23 August, 1975.

Biodegradation, Crude oil, Oceans, Microorganisms, *Nutrient requirements

The nutrient requirements for biodegradation are clarified. The range of microorganisms involved in biodeterioration has been extended. However, many other factors influencing the rate of biodegradation still remain to be investigated.

[from Proceedings of the Third Biodegradation Symposium. List of Contents. Applied Science Publishers, Ltd. July,1976]

C-0920-77
USE OF GENETICALLY-ENGINEERED MULTI-PLASMID MICROORGANISMS FOR RAPID DEGRADATION OF FUEL HYDROCARBONS
Friello, D. A., J. R. Myerore, and A. M. Chakrabarty. 1976.
Proceedings of the Third International Biodegradation Symposium. J. M. Sharpley and A. M. Kaplan (eds.). Barking, Essex, Applied Science Publishers, Ltd., 1976. p. 205-214. Symposium held in Kingston, Rhode Island, 17-23 August, 1975.

Biodegradation, Hydrocarbons, Bacteria, *Multi-plasmid microorganisms

Transmissible plasmids in different strains of Pseudomonas putida carry the genes specifying enzymes involved in the biodegradation of a number of hydrocarbons. Transfer of these plasmids into one strain can create a multi-plasmid strain capable of growing faster with crude oil than any of the naturally-occurring mono-plasmid parents.

[from Proceedings of the Third International Biodegradation Symposium. List of Contents. Applied Science Publishers, Ltd. July, 1976]

C-0921-77
METHODS AND INTERPRETATION IN MEASUREMENT OF OIL BIODEGRADATION RATE
Gibbs, C. F. 1976.
Proceedings of the Third International Biodegradation Symposium. J. M. Sharpley and A. M. Kaplan (eds.). Barking, Essex, Applied Science Publishers, Ltd., 1976. p. 127-140. Symposium held in Kingston, Rhode Island, 17-23 August, 1975.

Biodegradation, Hydrocarbons, Oxidation, *Oil biodegradation rate

Various methods of measuring the extent and rate of oil biodegradation are discussed. Relationships between oxidation rate and the supply of nutrient N were obtained. Oxygen uptake implied a lesser amount of destruction than did recovery of oil. Changes in the physical properties of the oil are noted.

[from Proceedings of the Third International Biodegradation Symposium. List of Contents. Applied Science Publishers, Ltd. July, 1976]

C-0922-77
INITIAL REACTIONS IN THE BACTERIAL DEGRADATION OF AROMATIC HYDROCARBONS [English summary]
Gibson, D. T. 1976.
Zentralblatt fuer Bakteriologie, Parasitenkunde, Infektionskrankheiten und Hygiene, Abteilung 1: Originale, Reiche B 162(1-2):157-168.

Biodegradation, Aromatic hydrocarbons, Bacteria, *Mammals

Mammals incorporate one atom of molecular oxygen into aromatic hydrocarbons to form arene oxides. Bacteria incorporate two atoms of molecular oxygen to form *cis*-dihydrodiols; arene oxides are hydrated and produce *trans*-dihydrodiols in mammals.

[from Chemical Abstracts 85(19): #139564k. 1976]

C-0923-77
MICROBIAL DEGRADATION OF CARCINOGENIC HYDROCARBONS AND RELATED COMPOUNDS
Gibson, D. T. 1976.
Sources, Effects and Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 224-238. Proceedings of the Symposium, American University, Washington, D.C., 9-11 August, 1976.

Biodegradation, Aromatic hydrocarbons, PAH, Carcinogens, Microorganisms

Metabolic activation by organisms is believed to cause the carcinogenicity of several polycyclic aromatic hydrocarbons (PAH). This paper reviews the bacterial and mammalian oxidation processes for aromatic hydrocarbons and polycyclic aromatic hydrocarbons that are responsible for potentially carcinogenic compounds.

C-0924-77
MICROBIAL DEGRADATION OF POLYCYCLIC AROMATIC HYDROCARBONS
Gibson, D. T. 1976.
Proceedings of the Third International Biodegradation Symposium. J. M. Sharpley and A. M. Kaplan (eds.), Barking, Essex, Applied Science Publishers, Ltd. 1976. p. 57-66. Symposium held in Kingston, Rhode Island, 17-23 August, 1976.

Biodegradation, PAH, Microorganisms, Bacteria , Carcinogens

Mammalian microsomes oxidize polycyclic aromatic hydrocarbons (PAH) to arene oxides, the suggested toxic or carcinogenic agents. Results of bacterial degradation studies indicate that bacteria oxidize PAH by a different mechanism.

[from Proceedings of the Third International Biodegradation Symposium. List of Contents. Applied Science Publishers, Ltd. July, 1976]

C-0925-77

MICROBIOLOGICAL ASPECTS OF SUPERSONIC AIRCRAFT FUEL

Hill, E. C., and A. R. Thomas. 1976. Proceedings of the Third International Biodegradation Symposium. J. M. Sharpley and A. M. Kaplan (eds.). Barking, Essex, Applied Science Publishers, Ltd., 1976. p. 157-176. Symposium held in Kingston, Rhode Island, 17-23 August, 1975.

Biodegradation, Fuels, Microorganisms, *Supersonic aircraft fuel

Summary not available.

[from Proceedings of the Third International Biodegradation Symposium. List of Contents. Applied Science Publishers, Ltd. July, 1976]

C-0926-77

BIODEGRADATION OF HIGH-OCTANE GASOLINE

Jamison, V. W., R. L. Raymond, and J. O. Hudson. 1976. Proceedings of the Third International Biodegradation Symposium. J. M. Sharpley and A. M. Kaplan (eds.). Barking, Essex, Applied Science Publishers, Ltd., 1976. p. 187-196. Symposium held in Kingston, Rhode Island, 17-23 August, 1975.

Biodegradation, Gasoline, Groundwater, *Nutrient addition

Groundwater contaminated with gasoline was treated with fertilizer to enhance biodegradation. Cultures isolated from the groundwater were evaluated for their ability to degrade gasoline. Several components did not appear to be utilized for growth, which raises the question of whether complete degradation of the gasoline is possible.

C-0927-77

BIODEGRADATION OF HIGH-OCTANE GASOLINE IN GROUNDWATER

Jamison, V. W., R. L. Raymond, and J. O. Hudson, Jr. 1975. Developments in Industrial Microbiology 16:305-312.

Biodegradation, Gasoline, Groundwater, Pennsylvania, *Nutrient addition

Microbial degradation was studied as a possible means of removing the remaining gasoline in the contaminated water supply of Amber, Pennsylvania, after a gasoline pipeline leak. Laboratory studies showed there was a small microbial population that could utilize high-octane gasoline as the sole carbon source, but nitrogen, phosphate and oxygen were limiting factors for maximum utilization. Results of analyses of the water after the addition of fertilizer and air to several wells are discussed.

C-0928-77
THE VARIETY OF PETROLEUMS AND THEIR DEGRADATIONS
Kallio, R. E. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 214-223. Proceedings of the Symposium, American University, Washington, D.C., 9-11 August, 1976.

Biodegradation, Crude oil, Hydrocarbons, Analytical techniques, *Petroleum varieties

"Petroleums are all different from each other. The reasons, the processes, the alterations by which these changes are arrived at are noted. The implications of these are directed toward environmental studies of oil spills and their effects on the biosphere."

C-0929-77
THE TWO FACES OF BIODETERIORATION
Lamanna, C. 1976.
Proceedings of the Third International Biodegradation Symposium. J. M. Sharpley and A. M. Kaplan (eds.), Barking, Essex, Applied Science Publishers, Ltd., 1976. p. 21-28. Symposium held in Kingston, Rhode Island, 17-23 August, 1976.

Biodegradation, Hydrocarbons, Microorganisms

Summary not available.

[from Proceedings of the Third International Biodegradation Symposium. List of Contents. Applied Science Publishers, Ltd. July, 1976]

C-0930-77

PETROLEUM-OXIDIZING MICROORGANISMS IN THE SOUTHERN AND CENTRAL PARTS OF THE ATLANTIC OCEAN [in Russian]

Lebed, A. A. 1975.
Biologicheskie Issledovaniya Trop. Okeana. V. N. Greze (ed.). Kiev, "Naukova Dumka," 1975. p. 10-16.

Biodegradation, Oxidation, Microorganisms, Bacteria, Pollution control, Atlantic Ocean

Forty-two of the 109 heterotrophic microorganisms isolated from the southern and central parts of the Atlantic Ocean showed growth on media containing petroleum or petroleum products. More than 50% of these bacteria were isolated from surface water samples or samples collected at 100m, where a significant difference in temperature exists. The oil-oxidizing bacteria belonged to the genera *Pseudobacterium*, *Pseudomonas*, *Micrococcus*, and *Bacterium*. The significance of these bacteria in eliminating marine oil pollution is discussed.

[from Chemical Abstracts 85(25): #188936s. 1976]

C-0931-77

METABOLISM OF PETROLEUM HYDROCARBONS IN MARINE SEDIMENTS

Lee, R. F. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 333-344. Proceedings of the Symposium, American University, Washington, D.C., 9-11 August, 1976.

Biodegradation, Hydrocarbons, Metabolism, Sediments, Microorganisms, Marine organisms, Benthos

Thirty-nine recent studies on the metabolism and biodegradation of petroleum hydrocarbons by benthic microbes and other marine organisms are synthesized to trace the general pathways of hydrocarbon breakdown in marine sediments.

C-0932-77

BIODEGRADATION OF PETROLEUM HYDROCARBONS BY MARINE MICROBES

Lee, R. F., and C. Ryan. 1976.
Proceedings of the Third International Biodegradation Symposium. J. M. Sharpley and A. M. Kaplan (eds.). Barking, Essex, Applied Science Publishers, Ltd., 1976. p. 119-126. Symposium held in Kingston, Rhode Island, 17-23 August, 1975.

Biodegradation, Hydrocarbons, Microorganisms, Seawater

Radioactive hydrocarbons were added to water samples from three areas. In the first 24 hours, between 1% and 5% of the hydrocarbon was degraded and released as $^{14}CO_2$. The rates of degradation of alkylated aromatics, pure aromatics and paraffinics differed. No evidence existed for hydrocarbon degradation by isolated phytoplankton.

[from Proceedings of the Third International Biodegradation Symposium. List of Contents. Applied Science Publishers, Ltd. July, 1976]

C-0933-77

HYDROCARBON DEGRADATION IN THE PRESENCE OF OTHER ORGANIC SUBSTANCES BY BACTERIA ISOLATED FROM SEAWATER

Le Petit, J., and S. Tagger. 1976.
Canadian Journal of Microbiology 22(11):1654-1657.

Biodegradation, Hydrocarbons, Bacteria, Seawater, *Hexadecane, *Organic substances

Effects were measured of the presence of two organic substances on three bacterial strains isolated from seawater and grown on hexadecane. Acetate was found to reduce growth of all strains and particularly the hexadecane degradation by *Acinetobacter* sp. Trypticase-phytone, on the other hand, promoted the degradation by the three strains.

[from Petroleum Abstracts 17(2): #228,862. 1977]

C-0934-77

BACTERIAL DEGRADATION OF BUNKER 6C FUEL OIL

Liu, D., and P. T. S. Wong. 1976.
Proceedings of the Third International Biodegradation Symposium. J. M. Sharpley and A. M. Kaplan (eds.). Barking, Essex, Applied Science Publishers, Ltd., 1976. p. 175-186. Symposium held in Kingston, Rhode Island, 17-23 August, 1975.

Biodegradation, Fuel oil, Bacteria, Soil

A bacterium isolated from the soil of a local refinery was able to degrade Bunker 6C fuel oil, with the n-alkane fractions being the primary target for degradation. The bacteria could oxidize the Bunker 6C fuel oil over a wide range of oil concentrations.

[from Proceedings of the Third International Biodegradation Symposium. List of Contents. Applied Science Publishers, Ltd. July, 1976]

C-0935-77
A PRELIMINARY MODEL OF OIL DECOMPOSITION IN SOILS
McGill, W. 1975.
Conference on the Environmental Effects of Oil and Salt Water Spills on Land, Banff, Alberta, 1975. Alberta Environment, and University of Calgary, 1975. p. 291-312.

Biodegradation, Oil spills, Soil, Decomposition, Microorganisms, Models, Nutrient demand

A model of oil decomposition in soil was tested to determine its sensitivity to nitrogen remineralization at high and low oil concentrations. The rate of oil decomposition and amount of oil were found to be more important in controlling nitrogen demand.

C-0936-77
SELF PURIFICATION OF THE SEAS OF NORTHERN EUROPE BY THE REMOVAL OF PETROLEUM PRODUCTS [in Russian]
Mironov, O. G., and A. A. Lebed. 1975.
Biologicheskoe Samoochishchenie i Formirovanie Kachestva Vody, Materialy Vsesoyuznogo Simpoziuma po Sanitarnoi Gidrobiologii, 2nd. p. 22-24.

Biodegradation, Petroleum products, Microorganisms, Barent Sea, Baltic Sea, Atlantic Ocean

The degree of petroleum product decomposition by microorganisms in the Baltic and Barent Seas and in the north-eastern Atlantic Ocean was investigated. The quantity of oxidizing microorganisms was directly proportional to the degree of water contamination.

[from Chemical Abstracts 86(6): #34052j. 1977]

C-0937-77
METABOLISM OF HYDROCARBONS BY MICROORGANISMS [English summary]
Meryng, A. 1976.
Postepy Mikrobiologii 15(1):57-69.

Biodegradation, Hydrocarbons, Metabolism, Microorganisms

"A review with 63 references of the assimilation of n-alkanes and other hydrocarbons, mechanisms of n-alkane oxidation by microorganisms, and the substrate specificity of microbial enzymes for the hydrocarbons."

[from Chemical Abstracts 85(21): #156154u. 1976]

C-0938-77
ROLE OF MICROORGANISMS IN THE WATER ENVIRONMENT [English summary]
Pawlaczyk-Szpilowa, M. 1976.
Postepy Mikrobiologii 15(2):17-27.

Biodegradation, Oil spills, Microorganisms

"A review with 39 references."

[from Chemical Abstracts 86(6): #34037h. 1977]

C-0939-77
THE MICROBIAL DEGRADATION OF DIESEL OIL IN MULTISTAGE CONTINUOUS CULTURE
Pritchard, P. H., R. M. Ventullo, and J. M. Suflita. 1976.
Proceedings of the Third International Biodegradation Symposium. J. M. Sharpley and A. M. Kaplan (eds.). Barking, Essex, Applied Science Publishers, Ltd., 1976. p. 67-78.
Symposium held in Kingston, Rhode Island, 17-23 August, 1975.

Biodegradation, Fuel oil, Microorganisms, Freshwater, *Continuous culture

Oil layers approximately 1-2 mm thick were placed on samples of freshwater. Microbial growth appeared in 5-10 days; the oil layer was completely removed in 120 days. The degradation process was sensitive to environmental variables.

[from Proceedings of the Third Biodegradation Symposium. List of Contents. Applied Science Publishers, Ltd. July, 1976]

C-0940-77
OXIDATION OF PETROLEUM AND PETROLEUM PRODUCTS BY MICROORGANISMS ISOLATED FROM THE CASPIAN SEA [in Russian]
Salmanov, M. A., S. N. Aliev, and Z. N. Shakhmatova. 1975.
Mikrobiol. Metody Bor'by Zagryaz. Okruzhayushchei Sredy, Tezisy Dokl. Konf., 1975.
V. A. Lambina and V. N. Uarova (eds.). Pushchino USSR, Akad. Nauk SSSR, 1975. p. 105-106.

Biodegradation, Crude oil, Petroleum products, Bacteria, Caspian Sea, USSR

One hundred sixty-four strains of hydrocarbon-degrading bacteria from the Caspian Sea were cultured under laboratory conditions on petroleum and petroleum products. Maximal growth occurred with crude oil and kerosene. Biodegrading bacteria were more abundant in the water than in the bottom sediments.

[from Chemical Abstracts 86(7): #39962r. 1977]

C-0941-77
PETROLEUM MICROBIOLOGY
Schwartz, R. D., and W. W. Leathen. 1976.
Industrial Microbiology. B. M. Miller and W. Litsky (eds.). New York, McGraw-Hill, 1976. p. 384-411.

Biodegradation, Crude oil, Petroleum products, Environmental effects, Microorganisms, Oxidation

"A review with 40 references on environmental effects of microbes on petroleum and petroleum products, microbial oxidation of hydrocarbons, and beneficial aspects of petroleum microorganisms."

[from Chemical Abstracts 85(23): #173909e. 1976]

C-0942-77
SOME DATA ON THE MICROFLORA OF THE GROUNDWATERS FROM THE SOVETSKOE PETROLEUM DEPOSIT OF THE TOMSK DISTRICT [in Russian]
Shamolina, Z. P., and A. D. Nazarov. 1975.
Izvestiya Tomskogo Politekhnincheskogo Instituta No. 237: 59-62.

Biodegradation, Microorganisms, Hydrocarbons, Petroleum products, Crude oil, Groundwater, USSR

"Microorganisms oxidizing hexane, phenol, benzene, and petroleum and CH_4-producing microorganisms were found in groundwaters from crude oil-containing geologic layers 6-2200 m deep."

[from Chemical Abstracts 85(21): #156417g. 1976]

C-0943-77
USE OF MICROORGANISMS UNDER SPECIAL MEDIUM CONDITIONS. I.
USE OF PETROCHEMICAL PRODUCTS BY MICROORGANISMS [in Japanese]
Uyema, H., and H. Horikoshi. 1976.
Hakko To Kogyo 34(11):851-866.

Biodegradation, Petrochemicals, Microorganisms, Metabolism

This review with 93 references includes such topics as the conditions of growth for microorganisms, characteristics of petrochemical products as substrates, and microorganisms utilizing petrochemical products as C sources.

[from Chemical Abstracts 86(7): #39846f. 1977]

C-0944-77
MODELLING OF THE BREAKDOWN AND THE MOBILIZATION OF HYDROCARBONS IN UNSATURATED SOIL LAYERS
Verstraete, W., R. Vanloocke, R. De Borger, and A. Verlinde. 1976.
Proceedings of the Third International Biodegradation Symposium. J. M. Sharpley and A. M. Kaplan (eds.). Barking, Essex, Applied Science Publishers, Ltd., 1976. p. 99-112. Symposium held in Kingston, Rhode Island, 17-23 August, 1975.

Biodegradation, Hydrocarbons, Soils, Monitoring, Models

Three different zones occur in hydrocarbon polluted soils. In each layer, monitoring of the biodegradation process is by different technique. In the layer on a level with the aquifer, biodegradation is mainly anoxic. Models of the various processes are discussed.

[from Proceedings of the Third International Biodegradation Symposium. List of Contents. Applied Science Publishers, Ltd. July, 1976]

C-0945-77
PETROLEUM: DEGRADATION BY ESTUARINE ORGANISMS
Walker, J. D., and R. R. Colwell. 1976.
Proceedings of the Third International Biodegradation Symposium. J. M. Sharpley and A. M. Kaplan (eds.). Barking, Essex, Applied Science Publishers, Ltd., 1976. p. 197-204. Symposium held in Kingston, Rhode Island, 17-23 August, 1975.

Biodegradation, Crude oil, Microorganisms, Estuaries, Chesapeake Bay

This paper reports on the seasonal variation in the numbers and activity of petroleum-degrading microorganisms from oil-contaminated and oil-free environments. Information on the susceptibility of petroleum to microbial degradation by indigenous microorganisms of Chesapeake Bay is presented.

[From Proceedings of the Third International Biodegradation Symposium. List of Contents. Applied Science Publishers, Ltd. July, 1976]

C-0946-77
SAMPLING DEVICE FOR MONITORING BIODEGRADATION OF OIL AND OTHER POLLUTANTS IN AQUATIC ENVIRONMENTS
Walker, J. D., and R. R. Colwell. 1977.
Environmental Science and Technology 11(1):93-95.

Biodegradation, Crude oil, Bacteria, Monitoring, Sampling, Fate

The fate of crude oil in the aquatic environment was studied in a sampling chamber for four weeks; 97% of the oil was removed by biodegradation. An increase in the total aerobic, heterotrophic microbial population, including lipolytic bacteria, was noted and was accompanied by a decrease in the amylolytic bacteria population.

C-0947-77
ROLL OF AUTOCHTHONOUS BACTERIA IN THE REMOVAL OF SPILLED OIL FROM SEDIMENT
Walker, J. D., and R. R. Colwell. 1977.
Environmental Pollution 12(1):51-56.

Biodegradation, Oil Spills, Sediments, Bacteria, Chesapeake Bay, *Colgate Creek

The sediment of Colgate Creek in Baltimore Harbor of Chesapeake Bay showed a significant increase in oil concentration after an oil spill. Within a month after the spill, oil concentration diminished by 75%; this decrease is attributed to bacterial degradation.

C-0948-77
THE MICROBIAL UTILIZATION OF BUTADIENE
Watkinson, R. J., and H. J. Somerville. 1976.
Proceedings of the Third International Biodegradation
Symposium. J. M. Sharpley and A. M. Kaplan (eds.).
Barking, Essex, Applied Science Publishers, Ltd., 1976.
p. 35-42. Symposium held in Kingston, Rhode Island,
17-23 August, 1975.

Biodegradation, Hydrocarbons, Metabolism, Microorganisms,
*Butadiene

Summary not available.

[From Proceedings of the Third International Biodegradation
Symposium. List of Contents. Applied Science Publishers,
Ltd. July, 1976]

B. PHYSICAL CHANGES OF OIL

C-0949-77
SURFACE TENSION SPREADING OF CRUDE OIL ON ICE
Chen, E. C., and D. K. Charles. 1976.
Marine Science Communications 2(1):1-11.

Crude oil, Ice, Spreading, *Oil-on-ice

The spreading of crude oil on ice passes through three distinct stages: gravity-inertia, gravity-viscous, and surface tension viscous. Spreading experiments were carried out on artificial ice surfaces and the surface tension-viscous spreading of crude oil on ice was studied.

[from Underwater Information Bulletin 8(6): #7612/1350. 1976]

C-0950-77
CHARACTERIZATION OF THE EVAPORATION RATES OF COMPLEX HYDROCARBON MIXTURES UNDER ENVIRONMENTAL CONDITIONS
Goodwin, S. R., D. Mackay, and W. Y. Shiu. 1976.
Canadian Journal of Chemical Engineering 54(4):290-294.

Oil spills, Hydrocarbons, Evaporation, Solution

Physical parameters governing evaporation rates of spilled hydrocarbon mixtures such as petroleum are discussed, and the basis of a methodology for establishing evaporation rates under various environmental conditions is outlined. Evaporation and dissolution rates under spreading and non-isothermal conditions are briefly considered.

[from Chemical Abstracts 86(2):#6929g. 1977]

C-0951-77
OIL IN SEA ICE
Lewis, E. L. 1976.
Pacific Marine Science Report No. 76-12. 26 p.

Ice, Oil spills, Movement, Behavior, Offshore drilling, Environmental effects, Arctic, Canada, *Blowouts, *Oil in ice

The following topics are covered: formation and structure of sea ice, movement of spilled oil from the sea-bed to the sea surface, oil at the ice/water interface, migration of oil through ice, oil at the ice surface, and effects of blowouts.

[from Petroleum Abstracts 17(7): #230,423. 1977]

C-0952-77

THE PHYSICAL BEHAVIOR OF OIL SPILLS ON NORTHERN TERRAIN

Mackay, D. 1975.
Conference on the Environmental Effects of Oil and Salt Water Spills on Land, Banff, Alberta, 1975. Alberta Environment, and University of Calgary, 1975. p. 81-110.

Oil spills, Behavior, Statistical analysis, Weathering, Pipelines, Canada, Inland

This paper deals specifically with the terrain of the Mackenzie Valley which will probably be the location of an oil pipeline to be constructed in the 1980's. An analysis of the spill frequency data indicates that this pipeline may be subject to about two large spills per year, the average volume being about 1,600 m^3. In predicting the resultant physical behavior, the following factors must be defined: weather (or climate), the oil properties, the condition of the soil and the ground cover, and the topography.

C-0953-77

WATER SOLUBLE HYDROCARBONS AND THEIR DETECTION

Peake, E., M. T. Strosher, M. Strosher, and G. Hodgson. 1975.
Conference on the Environmental Effects of Oil and Salt Water Spills on Land, Banff, Alberta, 1975. Alberta Environment, and University of Calgary, 1975. p. 184-229

Oil spills, Behavior, Hydrocarbons, Groundwater, *Surface waters, *Water-soluble fractions

A number of experimental observations dealing with the interaction between spilled oil and surface waters, shallow near-surface groundwaters, and subsurface waters are considered. In the event of an oil spill, the water-soluble hydrocarbons, which are mainly methyl benzene and methyl naphthalene compounds, are rapidly dissolved in surface waters. The water-naphthalene compounds are strongly fluorescent and provide a useful basis for detecting oil leaks. Some water-soluble compounds are persistent, continuing in the water for at least two and one-half years even with continuous exposure to the atmosphere.

C-0954-77
MODELING OF OIL EVAPORATION IN AN AQUEOUS ENVIRONMENT
Wang, H., W. E. Yang, and C. P. Huang. 1976.
Final report, FMS-RANN-3-76.

Models, Evaporation, Oil spills, Weathering

A numerical model developed to predict changes in oil through evaporation is summarized. Evaporation dominates in the early stages of the weathering of oil and petroleum products.

[from University of Delaware Marine Publications Catalog. p. 31. Summer, 1976]

3. CHEMICAL CHANGES OF OIL

C-0955-77
TOXIC HYDROPEROXIDES: PHOTOCHEMICAL FORMATION FROM PETROLEUM CONSTITUENTS
Larson, R. A., D. W. Blankenship, and L. H. Hunt. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 298-308. Proceedings of the Symposium, American University, Washington, D.C., 9-11 August, 1976.

Oxidation, Fuel oil, Toxicity, Yeasts, *Hydroperoxides

Short-term ultraviolet radiation adjusted to simulate sunlight was found to form hydroperoxides in No. 2 fuel oil. These substances were produced from the benzylic hydocarbons, were relatively water soluble and suppressed the growth of yeast cultures at low concentrations. Some of their breakdown products, including carbonyl compounds, phenols and acids, also inhibited growth.

4. GENERAL FATE OF OIL

C-0956-77
NOAA'S ACTIVITIES IN ENERGY RELATED MEASUREMENT AND MONITORING R&D
Bestul, A. B., and W. L. Pugh. 1976.
EPA National Conference on Health, Environmental Effects, and Control Technology of Energy Use, Washington, D.C., 1976. 5 p.

Oil spills, Fate, Movement, Sampling, Monitoring, Oceans, NOAA

Four oceanic projects will develop from NOAA's energy-related activities: oil spill concentrations and trajectory forecasting, a shipboard environmental data acquisition system, a water sampling program, and standardized marine monitoring techniques.

[from Environment Abstracts 6(9): #76-05802. 1976]

C-0957-77
THE FATE OF PETROLEUM IN THE OPEN OCEAN
Butler, J. N., B. F. Morris, and T. D. Sleeter. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 287-297. Proceedings of the Symposium, American University, Washington, D.C., 9-11 August, 1976.

Oil spills, Crude oil, Fate, Evaporation, Dispersion, Biodegradation, Oxidation, Tar

Petroleum spilled at sea undergoes evaporation, dispersion and degradation, including photochemical oxidation and biodegradation. Although physicochemical dispersion processes which distribute hydrocarbons throughout the environment can be studied by quantitative models, the degradation processes that actually remove petroleum hydrocarbons from the environment are poorly understood as is the ultimate fate of petroleum at sea.

C-0958-77
OIL, WATER AND SQUIGGLY THINGS
Claggett, F. M. 1976.
Petroleum Today 17(3):20-21.

Fate, Oil Spills, Biological effects, Marine organisms, API

The American Petroleum Institute has invested about $2.75 million to date in fate-of-oil studies. A typical example of an oil industry-sponsored research project on the effects of an oil spill on marine plants and burrowing organisms is briefly reviewed.

C-0959-77
THE CONCENTRATIONS OF OIL IN SEAWATER RESULTING FROM NATURAL AND CHEMICALLY INDUCED DISPERSION OF OIL SLICKS
Cormack, D., and J. A. Nichols. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 381-385.
(American Petroleum Institute No. 4284)

Oil spills, Crude oil, Cleanup, Dispersants, Spreading, Emulsification, Weathering

Factors relating to the dissipation of Ekofisk and Kuwait crude oil spills are discussed and chemical dispersants used to cleanup the spills are presented. Evaporation, emulsion formation, spreading, and natural dispersion of oil into the water column are also discussed. Test results indicate that spreading of the oil leads to extensive evaporative losses. No significant effects on marine life were reported as a result of dispersing oil slicks.

C-0960-77
INFLUENCE OF SAMPLING METHOD ON THE CHEMICAL COMPOSITION OF WATER SURFACE FILM
Daumas, R. A., P. L. Laborde, J. C. Marty, and A. Saliot. 1976.
Limnology and Oceanography 21(2):319-326.

Hydrocarbons, Refineries, Mediterranean Sea, Sampling, *Surface microlayer composition

Surface microlayer composition was compared at two sites, having different degrees of water pollution, near the northern Mediterranean coast. Eutrophication due to river runoff and hydrocarbon pollution from refinery effluents may contribute to an increase in the enrichment factor.

C-0961-77
SUBSURFACE BIOPHYSIOCHEMICAL TRANSFORMATIONS OF SPILLED CRUDE OIL
Duffy, J. J., E. Peake, and M. F. Mohtadi. 1976.
Conference on the Environmental Effects of Oil and Salt Water Spills on Land, Banff, Alberta, 1975. Alberta Environment, and University of Calgary, 1976. p. 136-183.

Oil spills, Inland, Fate, Crude oil, Models,Contamination Groundwater

The persistence of water soluble hydrocarbons from crude oil spills on land was investigated as a source of groundwater contamination by means of theoretical models, percolation experiments, and core sampling at spill sites. Based on the results obtained, it is concluded that the water soluble components of crude oil spilled on land are very persistent and represent long-term environmental threats to groundwater.

C-0962-77
SUBSURFACE PERSISTENCE OF CRUDE OIL SPILLED ON LAND AND ITS TRANSPORT IN GROUNDWATER
Duffy, J. J., E. Peake, and M. F. Mohtadi. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 475-478.
(American Petroleum Institute No. 4284)

Fate, Oil spills, Inland, Crude oil, Contamination, Groundwater, *Persistence

The persistence of petroleum hydrocarbons in groundwater was studied using theoretical models, laboratory percolation experiments, and analysis of core samples from spill sites. Even with some biodegradation and evapotranspiration activity, the oil components constitute extremely persistent contaminants and require enormous quantities of water to reduce the spill leachate to acceptable drinking water levels.

C-0963-77
THE USE OF A DIAGNOSTIC CIRCULATION MODEL FOR OIL TRAJECTORY ANALYSIS
Galt, J. A., and C. H. Pease. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 447-454.
(American Petroleum Institute No. 4284)

Models, Oil spills, Movement, Drift, OCS, Gulf of Alaska

A diagnostic ocean current circulation model has been developed for studying oil trajectories along continental shelf regions. In this report, the model formulation is outlined and test applications in predicting currents and pollutant trajectories for the Northeast Gulf of Alaska are presented and compared with observational data.

C-0964-77
A PROBABILISTIC MODEL FOR DISPERSIVE OIL LOSSES BENEATH OIL BOOMS
Fallah, M. H., and R. M. Stark. 1976.
Ocean Engineering 3(6):383-390.

Oil slicks, Dispersions, Containment, Booms, Models, *Dispersive oil losses

Wave action and current turbulence can cause substantial oil losses from spill containment booms. The process of "dispersive oil loss," in which vertically dispersed oil particles when carried by current escape beyond the boom perimeter, is studied using a random walk model. Probabilistic descriptions for the volume of oil loss are derived. The model's application using a hypothetical oil slick is illustrated.

C-0965-77
FATE OF OIL FROM THE SUPERTANKER *METULA*
Hann, R. W., Jr. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 465-468.
(American Petroleum Institute No. 4284)

Metula oil spill, Fate, Tankers, Environmental effects, Beaches, Estuaries, Marine organisms, Strait of Magellan

The Metula grounding and oil spill disaster of August, 1974, in which nearly 54,000 tons of crude and fuel oil were spilled into the Strait of Magellan, is reviewed. The report summarizes the initial and long-term effects of the oil on the beaches, estuaries, waterfowl, and marine life of Tierra del Fuego. The oil is disappearing from the beaches at varying, but generally faster rates than from estuaries and protected areas. No attempt at cleanup was made and the ultimate fate of the oil is as yet uncertain.

C-0966-77
INVESTIGATION, PREDICTION, AND CONTROL OF THE CONTAMINATION OF GROUNDWATER BY OIL
Harper, T. R. 1976.
Petroleum Review 30(356):484-487.

Groundwater, Contamination, Hydrocarbons, Movement, Pollution Control

Refineries,tank farms, terminals, and pipelines are all capable of leaking hydrocarbons into groundwater. Methods of studying and controlling the subsurface migration of hydrocarbons are discussed, and the possibilities and consequences of subsurface contamination by hydrocarbons are assessed.

[from Petroleum Abstracts 16(50):#227,860. 1976]

C-0967-77
STORM RELATED OIL SPILL MOVEMENT ON THE BEAUFORT SEA SHELF
Hufford, G. L., T. M. Lissauer, and B. D. Thompson. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 455-460.
(American Petroleum Institute No. 4284)

Models, Oil spills, Drift, Shorelines, OCS, Beaufort Sea, *Storm modeling

A storm model which incorporates historical storm data has been developed for studying the wind drift trajectories of oil spills along the Beaufort Sea coast. The probability of an oil slick impacting the shoreline from five different sites and under different storm conditions is discussed.

C-0968-77
NEW YORK HARBOR OIL DRIFT PREDICTION MODEL
Kollmeyer, R. C., and M. E. Thompson. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 441-446.
(American Petroleum Institute No. 4284)

Models, Oil spills, Harbors, Spreading, Drift, New York

The spreading behavior and drift of oil spills in New York Harbor were studied using computer modeling techniques. The computer model equations are reviewed, and the parameters incorporated in the simulation, which include tidal currents, Hudson River flow, wind direction and velocity,are discussed.

C-0969-77
PRIORITIES IN FATE OF OIL SPILL RESEARCH
Kolpack, R. L. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 483-486.
(American Petroleum Institute No. 4284)

Models, Oil spills, Fate, Hydrocarbons, Spreading, Solution, Emulsification, Adsorption, Decomposition

A computer simulation model was used to study the interaction of different petroleum hydrocarbons with varying marine environmental conditions. Processes active at the water surfaces are considered to be most important. Suggested high priority research topics include: spreading, mixing, dissolution, emulsification, photochemical degradation, bottom transport and degradation, sorption of oil on particulates, and coordinated studies of nearshore processes.

C-0970-77
ELEMENTS OF MASS BALANCE RELATIONSHIPS FOR OIL RELEASED IN THE MARINE ENVIRONMENT
Kolpack, R. L., and N. B. Plutchak. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 345-357. Proceedings of the Symposium, American University, Washington, D.C., 9-11 August, 1976.

Models, Hydrocarbons, Oil spills, Oceans, Fate, Spreading, Evaporation, Biodegradation

A three-dimensional computer simulation model was designed to study the interaction and effects of variables which influence the composition, quantity and spatial distribution of hydrocarbons in the environment. For processes such as spreading, evaporation, mixing, dissolution and microbial degradation of oil, more than 40 different environmental variables were taken into account, including air and water temperature, wind velocity, water currents, solar radiation, dissolved oxygen and microbial populations.

C-0971-77

FATE AND EFFECTS OF OIL ON MARINE LIFE: PROGRESS REPORT ON RESEARCH SPONSORED BY THE AMERICAN PETROLEUM INSTITUTE

Lasday, A. H., and E. W. Mertens. 1976.
Offshore Technology Conference, 8th, Houston, Texas, 1976. OTC paper No. 2449. p. 275-283. (Also in Journal of Petroleum Technology November, 1976:1285-1288).

Fate, Toxicity, Oil spills, Contamination, Marine organisms, API

The results of API research into the acute and chronic effects of contaminants upon marine organisms are summarized. The research suggests that temporary exposure of a marine organism to oil does not result in permanent contamination. The composition of spilled oil changes rapidly with time, and toxicity is reduced by evaporation of the most toxic compounds. Thus, residues of oil after an offshore-platform mishap become relatively inert before they reach the most biologically sensitive shoreline area.

C-0972-77

FATE OF PETROLEUM COMPONENTS IN ESTUARINE WATERS OF THE SOUTHEASTERN UNITED STATES

Lee, R. F. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 611-616. (American Petroleum Institute No. 4284)

Hydrocarbons, Fate, Estuaries, Rivers, Atlantic coast, PAH, Adsorption, Biodegradation

Radiolabeled hydrocarbons and phenols were added to samples of estuarine river waters of the U.S. south Atlantic coast in order to observe the biodegradation and adsorption of hydrocarbons to particulates. The higher-weight polycyclic aromatic hydrocarbons in river waters were subject to low degradation rates and were found to preferentially adsorb onto detrital particles composed of a mixture of clay, organic matter, plankton remains, and living microbes.

C-0973-77

A COMPUTER SIMULATION TECHNIQUE FOR OIL SPILLS OFF THE NEW JERSEY - DELAWARE COASTLINE

Lissauer, I. M., J. C. Bacon, and M. C. Miller. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control,
Cleanup), New Orleans, March 8-10, 1977. p. 437-440.
(American Petroleum Institute No. 4284)

Models, Oil spills, Movement, Coasts, Offshore drilling, Ports, New Jersey, Delaware

Oil slick trajectories and impact locations were predicted for spills from two potential deepwater ports and two drilling sites off the New Jersey-Delaware coastline using a computer generated model. This report shows spill movement generated by severe conditions caused by a typical low-pressure coastal winter storm and those resulting from a typical summer high pressure system situated off the U.S. east coast.

C-0974-77

FATE OF CRUDE OIL SPILLED IN A SIMULATED ARCTIC ENVIRONMENT

MacGregor, C., and A. Y. McLean. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control,
Cleanup), New Orleans, March 8-10, 1977. p. 461-464.
(American Petroleum Institute No. 4284)

Oil spills, Fate, Arctic, Crude Oil, Evaporation, Weathering, Solution, Emulsification, Tar

The title study was conducted under laboratory conditions in order to understand changes in physical properties and chemical composition of crude oil spilled on cold water. Evaporation removed the largest quantity of the oil, whereas sinking and solution was minimal. The oil rapidly emulsified and in a matter of days coagulated into extremely persistent, non-weathering tarballs.

C-0975-77

WEATHERING OF OIL SPILLED ON COLD, OCEANIC WATER WITH PARTICULAR REFERENCE TO SULFUR CONTAINING COMPOUNDS

MacGregor, D. R. C. 1975.
Masters Thesis, Dalhousie University, Halifax, Nova Scotia.

Crude oil, Oil spills, Weathering, Tar, Evaporation, Solution, *Sulfur compounds

The simulated weathering of crude oil from the liquid to the tarball state was studied with emphasis on the detection of changes in the sulfur content of the oil. Evaporation removed most of the spilled oil; solution was minimal at first but increased with time. Tarball formation was rapid and resulted in a complete cessation of weathering effects. Elemental sulfur fractions in the oil decreased with weathering, whereas the relative amount of organic sulfur increased with time.

C-0976-77
SEDIMENTS - SOURCES OR SINKS FOR PETROLEUM HYDROCARBONS?
Meyers, P. A. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 309-324. Proceedings of the Symposium, American University, Washington, D. C. 9-11 August, 1976.

Hydrocarbons, Sediments, Fate, Crude oil, Behavior, Sources, Environmental effects

The adsorption and incorporation of petroleum hydrocarbons in sediments, and conversely the slow release of hydrocarbons by sediments into overlying waters were studied; results were compared with the behavior of biogenic hydrocarbons from Lake Huron sediments and other areas. It is concluded that burial in sediments can effectively prevent further interaction between trapped hydrocarbons and the environment. However, hydrocarbons in surface sediments can continue to interact with surrounding waters by physical reworking of the sediments, bioturbation, or solution.

C-0977-77
PHOTO-OXIDATION OF CRUDE OILS
Nagata, S., and G. Kondo. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 617-620. (American Petroleum Institute No. 4284)

Crude oil, Chemical analysis, Chromatography, Oxidation, Evaporation, Biodegradation, *Photooxidation

Gas-liquid chromatography was used to analyse changes with elapsed time for five different crude oils. Changes monitored included specific gravity, viscosity and amount of water in oil. Processes of evaporation, biodegradation and photodecomposition were studied. Evaporation affected mainly the paraffins with low boiling points; biodegradation affected mainly the normal paraffins. Aromatic and heteroaromatic hydrocarbons which were not readily removed by biodegradation or evaporation were decomposed by photo-irradiation.

C-0978-77
THE ENVIRONMENTAL LOAD AND CYCLE OF POLYCYCLIC AROMATIC HYDROCARBONS
Suess, M. J. 1976.
The Science of the Total Environment 6(3):239-250.

PAH, Carcinogens, Fate, Decomposition, Environment effects

The formation, degradation and environmental effects of carcinogenic polycyclic aromatic hydrocarbons (PAH) are reviewed. Various natural and manmade PAH sources, such as open burning, heating, power generation, combustion of refuse, oil, and hydrocarbon fuels, are examined.

C-0979-77
1970 *ARROW* BUNKER C OIL IN 1975: RESIDENCE TIME AND MOBILITY OF STRANDED OIL - IMPLICATIONS
Vandermeulen, J. H. 1975.
Conference on the Environmental Effects of Oil and Salt Water Spills on Land, Banff, Alberta, 1975. Alberta Environment, and University of Calgary, 1975. p. 111-135.

Oil spill, Beaches, Fate, Movement, Sediments, Biological effects, Plankton, Benthos, Chedabucto Bay

The degree of contamination and pattern of residual oiling of a typical low-energy beach in a sheltered lagoon is described; observations on movement, residence time, and re-entry of Bunker C are presented. Large amounts of the fuel oil remain stranded along the shoreline of Chedabucto Bay five years after the grounding of the "Arrow". The stranded oil is slowly being released to the littoral and sub-littoral environments; main route of re-entry appears to be through the sediment. Zooplankton and phytoplankton in the area probably experience little or no direct hydrocarbon effects at the measured oil concentrations. However, epibenthic organisms and the meiobiota encounter much high concentrations, generally deleterious to growth, respiration, and chemoreception.

C-0980-77
PERSISTENCE OF NON-ALKANE COMPONENTS OF BUNKER C OIL IN BEACH SEDIMENTS OF CHEDABUCTO BAY, AND LACK OF THEIR METABOLISM BY MOLLUSCS
Vandermeulen, J. H., P. D. Keizer, and W. R. Penrose. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 469-474.
(American Petroleum Institute No. 4284)

Fuel oil, Sediments, Fate, Weathering, Hydrocarbons, Metabolism, Mollusks, Chedabucto Bay

Analysis of beach sediment cores from Chedabucto Bay shows that weathering of oil occurs in the top 15 cm of sediment, except for aromatic and cycloalkane components which are resistant and unaltered and become enriched in the sediments. Molluscs from oiled sediments and control organisms were assayed for their ability to metabolize and rid themselves of petroleum hydrocarbons. Both the oiled and non-oiled bivalves lacked the ability to induce hydroxylation activity (AHH) during petroleum exposure; depuration was incomplete and exceedingly slow.

C-0981-77
A COMPARATIVE SURVEY OF PETROLEUM HYDROCARBONS IN LAKE SEDIMENTS
Wakeham, S. G. 1976.
Marine Pollution Bulletin 7(11):206-211.

Hydrocarbons, Distribution, Sediments, Lakes

The distribution of petroleum hydrocarbons in lake sediments is related to the level of human activity in the respective drainage basins. Surface sediments in a lake surrounded by a major city were found to be contaminated with hydrocarbons, whereas no detectable contamination was found in a comparable lake located in a national park.

C-0982-77
COMPUTER MODELING OF OIL DRIFT AND SPREADING IN DELAWARE BAY
Wang, H., J. R. Campbell, and J. D. Ditmars. 1976.
Final report, CMS-RANN-1-76. 58 p.

Oil spills, Fate, Models, Drift, Spreading, Delaware Bay

The report provides information on computer modelling of oil transfer operations and prediction of oil spill dispersion. Two modes are considered: drifting and spreading. Physical processes involved in spreading are discussed with examples of field comparisons.

[from University of Delaware Marine Publications Catalog. p. 31. Summer, 1976]

C-0983-77
OIL SLICK SPREADING BENEATH A UNIFORM ICE COVER IN THE PRESENCE OF A CURRENT
Weiskopf, F. B., and M. S. Uzuner. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 293-300.
(American Petroleum Institute No. 4284)

Oil slicks, Spreading, Ice, *Current

Previous studies of oil spill extent and spreading rates conducted in still water beneath solid ice indicated that a spreading oil slick passes through three distinct phases: a gravity inertia phase, viscous-gravity phase, and viscous-surface tension phase. This study, which incorporated into the system a steady current of water beneath the ice cover and used crude oil and No. 2 fuel oil in tests, indicates that a fourth phase of spreading motion occurs in the presence of a current. This phase was identified as a turbulent drag-viscous drag phase. Based on test data, a first approximation predictor equation was developed for predicting the spreading of oil beneath uniform ice cover in the presence of a current.

F. OIL POLLUTION REGULATIONS

1. U.S. LEGISLATION

C-0984-77
OCZM RELEASES PROPOSED REGULATIONS FOR THE COASTAL ENERGY IMPACT PROGRAM
Anon. 1976.
OCS Update 1(6):1.

Regulations, Offshore development, Environmental protection, Economic effects, Delaware

Economic implications for Delaware of proposed Coastal Energy Impact Program (CEIP) regulations developed by the Office of Coastal Zone Management are briefly summarized. Included in the CEIP will be funding for grants which may be applied toward planning or devising protective measures for environmental and recreational resources affected by offshore development.

C-0985-77
OIL IMPACT LEGISLATION SIGNED INTO LAW JULY 26
Anon. 1976.
OCS Update 1(5):4.

Legislation, U.S., OCS, Offshore development, Environmental effects, Pollution control, Economics, Delaware

Amendments to the Federal Coastal Zone Management Act (PL94-370), which were signed into law in July, 1976, will in part provide for funds to be used to compensate for direct adverse impacts caused by OCS activity. These funds could be applied to help prevent losses to valuable ecological resources or to pay for oil spill containment and cleanup equipment. Possible economic and other benefits of this legislation to Delaware are briefly discussed.

C-0986-77
LEGAL CONSIDERATIONS FOR THE CONSTRUCTION AND OPERATION OF A DEEPWATER OIL TERMINAL IN THE DELAWARE BAY
Center for the Study of Marine Policy. 1975.
Report CMS-7-75. 27p.

Ports, Oil transfer, Legislation, Delaware Bay

"A study of appropriate legislation and other actions necessary to plan, construct, and operate a deepwater oil terminal, addressing the legal issues likely to be raised in the course of creating such a terminal."

[from University of Delaware Marine Publications Catalog. p. 10. Summer, 1976]

C-0987-77
MANDATORY OIL IMPORT PROGRAM
Federal Energy Administration. 1975.
Report No. FEA/D-76/303; PB 255608/2GA. 337p.

Regulations, Crude oil, Petroleum products, Environmental effects, Economic effects, FEA, *Mandatory Oil Import Program

"This report considers the environmental impact of, and alternatives to, regulations implementing Presidential Proclamation No. 3279, as recently amended by Proclamation Nos. 4210, 4341, and 4355, including amendments to FEA's Mandatory Oil Import Regulations, 10 C.F.R., Parts 206 and 213, and the Mandatory Petroleum Allocation and Price Program, 10 C.F.R., Parts 211 and 212. These regulations establish and distribute the burden of increased fees on imports of crude oil and petroleum products."

[from Petroleum Abstracts 17(3):#229,164. 1977]

C-0988-77
ENVIRONMENTAL CONTROLS: THE IMPACT ON INDUSTRY
Leone, R. A. (ed.). 1976.
Lexington, Massachusetts, D. C. Heath and Company, 1976. 129p.

Legislation, U.S., Pollution control, Refineries, Oil industry, Economic effects

Research findings are summarized from a 18-month study of the impact on various manufacturing industries of the 1972 amendments to the Federal Water Pollution Control Act. The petroleum refining industry is among the industries studied.

[from Pollution Abstracts 8(1):#77-00978. 1977]

C-0989-77
RECOVERING FOR MARINE LIFE DAMAGE: LEGAL ASPECTS OF ALLOCATING SOCIAL COSTS AND PROTECTING PUBLIC INTERESTS
Lutz, R. E., II, and J. P. Meck. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 11-14. (American Petroleum Institute No. 4284)

Environmental deterioration, Oil spills, Compensation, Wildlife, Marine organisms, Economics, *Legal aspects

Means for compensating and settling wildlife damage claims can be accomplished by direct cash payment, trust funds, specific replacement and restoration programs, maintenance of sanctuaries and reserves, and financing of wildlife refuges and habitats. Wildlife damage compensation is moving from the unquantifiable approach of civil penalties to an approach which allows for a quantification of damages. This article discusses many issues relating to such an expanded approach.

C-0990-77
PROBLEMS AND PERSPECTIVES IN RECOVERY OF OIL POLLUTION REMOVAL COSTS
Norris, W. H., and H. N. Johnston. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup),
New Orleans, March 8-10, 1977. p. 35-37. (American Petroleum
Institute No. 4284)

Legislation, Pollution control, Cleanup, Liability, Cost analysis, *Federal Water Pollution Control Act

The paper examines Sections 311(f) and (i) of the Federal Water Pollution Control Act (FWPCA) and discusses the statutory scheme for the recovery of clean-up costs by both government and private persons. The effectiveness of the scheme is assessed by reviewing statistics developed from the Coast Guard's Pollution Incident Reporting System data and records used in administering the revolving fund. Some of the problems that have been experienced are discussed and some proposed changes are considered.

C-0991-77
OIL SPILL LIABILITY AND COMPENSATION ("SUPERFUND")
Reynolds, J. L. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup),
New Orleans, March 8-10, 1977. p. 15-18. (American Petroleum
Institute No. 4284)

Legislation, U.S., Oil Spills, Liability, Compensation, *Superfund

The oil spill liability and compensation system in existence today ranges from little or no coverage in some instances to duplicative coverage in other instances. A national fund is proposed that would eliminate the need for all the other existing funds, would compensate for spills in any U.S. waters and would provide coverage at much less cost to the consumer. This paper reviews the existing system, the problems involved, the proposed Comprehensive Oil Pollution Liability and Compensation system (or "Superfund"), and the present status of the legislation.

2. STANDARDS AND GUIDELINES

C-0992-77
U.S. COAST GUARD AND OIL POLLUTION REGULATIONS (news brief)
Anon. 1976.
Oregon Commercial Fisheries Newsletter 6(3):4-5.

Regulations, U.S., Ships, Oil transfer, Bilges, Oil discharges, USCG

A brief review of the U.S. Coast Guard regulations on oil pollution from uninspected vessels is given. These regulations have been in effect since 1974 and include oil transfer procedures, bilge draining, and discharge procedures and deck lighting requirements.

C-0993-77
PUBLISHED REGULATORY GUIDELINES OF ENVIRONMENTAL CONCERN TO THE OIL INDUSTRY IN WESTERN EUROPE
CONCAWE Secretariat. 1976.
Stichting CONCAWE, Report 6/76. 49p.

Oil industry, Regulations, Pipelines, Wastewaters, Guidelines, Europe

The following guidelines are presented which apply to all or selected European countries: regulations relevant to the S content of fuels and gasoline composition; gasoline engine vehicle emission regulations; present legislation, technical requirements, and codes for pipelines; environmental noise control regulations; and liquid effluent discharge limits.

[from Pollution Abstracts 8(1):#77-00992. 1977]

C-0994-77
ONSHORE SEGMENT OF THE OIL AND GAS EXTRACTION POINT SOURCE CATEGORY
Environmental Protection Agency. 1976.
Federal Register 41(193):44949-44952.

Guidelines, Production, Exploration, Drilling, Wastewaters, EPA, *Onshore point source category

The proposed guidelines preclude the discharge of wastewater pollutants into navigable waters from any source associated with production, field exploration, drilling, well completion, or well treatment. They limit release of oil and grease to 45 mg/l for the beneficial use subcategory and to 100 mg/l for the other categories.

[from Pollution Abstracts 8(1):#77-00340. 1977]

C-0995-77

ONSHORE SEGMENT OF THE OIL AND GAS EXTRACTION POINT SOURCE CATEGORY: INTERIM FINAL RULE MAKING AND PROPOSED RULE MAKING

Environmental Protection Agency. 1976.
Federal Register 41(199):44941-44948.

Guidelines, Production, Extraction, Oil industry, Wastewaters, EPA, *Onshore point source category

The EPA has issued effluent guidelinus and standards which are applicable to existing sources for the onshore subcategory, the coastal subcategory, the beneficial use subcategory, and the stripper subcategory. The specified limitations are to be accomplished by the best practicable control technology available.

[from Pollution Abstracts 8(1):#77-00339. 1977]

C-0996-77

TEXACO EFFLUENT GUIDELINES FOR PETROLEUM MARKETING STORAGE AND DISTRIBUTION FACILITIES

Texaco. 1975.
Texaco Draft report to the Environmental Protection Agency, January 1975. 100p.

Guidelines, Oil industry, Wastewater treatment, Production, Storage, Distribution, Oil-water separation, Pollution control

In order to expedite resolution of the complex issues involved for petroleum marketing terminals, Texaco surveyed nine exemplary terminals having gravity separation to determine the oil and grease concentrations achievable by application of what the industry deems to be the 'best practicable control technology currently available'.

[from Urbanization and Water Quality Control, W. Whipple, Jr. (ed.). Minneapolis, Minnesota, American Water Resources Association, 1975. p. 216, 218.]

C-0997-77

THE PETROLEUM INDUSTRY AND COST-EFFECTIVE WATER QUALITY PLANNING

Wiley, M. A. 1975.
Urbanization and Water Quality Control. W. Whipple, Jr. (ed.). Minneapolis, Minnesota, American Water Resources Association, 1975. p. 211-219.

Guidelines, Wastewater treatment, Oil industry, Refineries, Legislation, Water quality, Economics

Legal and economic aspects of oil industry compliance with effluent guidelines and water pollution control regulations are examined. Improved legislation is called for to ensure equitable and cost-effective water quality planning by industries, municipalities, commerce and small business.

3. AGREEMENTS AND CONVENTIONS

C-0998-77
INTERNATIONAL REGULATION OF THE TANKER INDUSTRY
Gray, W. O., C. J. Carven, and G. L. Becker. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 7-10. (American Petroleum Institute No. 4284)

International conventions, IMCO, Regulations, Tankers, Pollution prevention.

This paper reports on progress during the past two years toward adoption of the International Convention for the Prevention of Pollution from Ships (1973 MARPOL) and broadens the subject to give a perspective on the "family" of IMCO conventions as they relate to tankers. The paper is divided into the following sections: technical progress towards IMCO 1973 MARPOL; ratification problems for IMCO 1973 MARPOL; the "family" of IMCO conventions; conclusions.

C-0999-77
IMCO AND THE EVOLVING INTERNATIONAL SCHEME FOR CONTROLLING MARINE POLLUTION
Schubert, F. P. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 3-6. (American Petroleum Institute No. 4284)

International conventions, IMCO, Pollution prevention, USCG

The origin, composition and functions of the Intergovernmental Maritime Consultative Organization (IMCO) and its expanding role in protection of the marine environment are described. The interrelationship between U.S. regulatory processes and IMCO activities is discussed. As the primary U.S. maritime regulatory and enforcement agency, the Coast Guard plays a leading role in IMCO affairs, particularly those concerned with marine pollution prevention.

6. BIBLIOGRAPHIES

C-1000-77
OIL SPILL IDENTIFICATION BIBLIOGRAPHY
Bentz, A. P. 1976.
CGR/DC-3/76; USCG-D-41-76. 9p.

Bibliographies, Oil spills, Source identification, Analytical techniques, Spectroscopy, Spectrometry, Chromatography

The latest state-of-the-art techniques in oil spill identification are reviewed. Included are low temperature luminescence, field ionization mass spectrometry, double-beam fluorescence, and dual detection gas chromatography. Current research in the field of oil identification is also covered.

[from Government Reports Announcements 76(22):#AD-A029 126/0GA. 1976]

C-1001-77
OCEAN LAW (a bibliography with abstracts)
Brown, R. J.
Report for 1964-October 1976. 236p.

Bibliographies, Legislation, U.S., International agreements, Oceans, Ships, Offshore drilling, Pollution prevention, Oil spills

This updated bibliography contains 231 abstracts (68 of which are new entries to the previous edition) covering national and international laws on fishing, underseas mining, shipping, dredging, territorial waters, navigation regulations, seafloor minerals, offshore drilling, and water pollution.

[from Government Reports Announcements 76(25):#NTIS/PS-76/0834/2GA. 1976]

C-1002-77
CARCINOGENICITY OF RESIDUAL FUEL OILS BY NONBIOLOGICAL LABORATORY METHODS: ANNOTATED BIBLIOGRAPHY. PART I. LABORATORY METHODS OF ANALYSIS. PART II. ANALYSIS RESULTS
Cichorz, R. S. 1976.
Contract E (29-2)-3533. NTIS No. RFP-2436. 16p.

Bibliographies, Fuel oils, Carcinogens, PAH, Analytical techniques, Petroleum products

The literature search is presented as an annotated bibliography, current as of January 1, 1975. Part I deals with laboratory chemical and physical methods of determining carcinogenicity and/or polynuclear aromatic hydrocarbons in residual fuel oils and contains

10 entries. Part II includes the results of testing specific fuel oils for carcinogenic components and contains 11 entries. Author index and subject categories are included.

[from ERDA Energy Research Abstracts 1(9):#17763. 1976]

C-1003-77
POLYCYCLIC AROMATIC HYDROCARBONS: OCCURRENCE AND ANALYSIS - A PARTIAL BIBLIOGRAPHY
Martin, A., and M. Blumer. 1975.
Technical report, Woods Hole Oceanographic Institute, WHOI-75-22.

Bibliographies, PAH, Sources, Fate, Analytical techniques, Chromatography, Spectroscopy, Carcinogens, Crude oil

This bibliography contains 1,055 references on the occurrence of polycyclic aromatic hydrocarbons in nature, their origin, composition, fate and analysis. The majority of citations refer to work reported between 1970 and mid-1973. Main topics include air and air particulates, automotive, benzo[a]pyrene, carcinogenesis, chromatography, crude oil and petroleum, extraction, fluorescence, infrared, mass spectra, water and others.

C-1004-77
OIL WATER SEPARATORS (a bibliography with abstracts)
Smith, M. F. 1976.
NTIS/PS-76/0863/1GA. 126p.

Bibliographies, Oil-water separation, Pollution control, Oil spills, Recovery, Ballast, Bilges

This NTIS research covers federally sponsored studies on oil water separators used primarily for pollution control. Included are centrifuge separators, coalescers, filters, oil spill recovery, and ballast and bilge water treatment.

[from Government Reports Announcements 76(26):#NTIS/PS-76/0863/1GA. 1976]

SECTION II: CURRENT RESEARCH PROJECTS

Title, contract information and a summary of project objectives are provided in each entry. Project notices have been obtained from the Smithsonian Science Information Exchange (SSIE), and from the National Oceanographic and Atmospheric Administration, National Sea Grant Program. Current status information and publications resulting from the projects are presented when such information is available from the principal investigators or performing organizations. The source of status information is given at the end of each entry.

Entries are grouped according to subject and then ordered by serial number within each subject division. The serial number designates the original issue of OIL SPILL AND OIL POLLUTION REPORTS in which the research project is listed:

R-001-74 to R-165-74	EPA-670/2-75-003 July 74 to October 74
R-166-74 to R-244-74	EPA-670/2-75-044 November 74 to February 75
R-269-75 to R-304-75	EPA-600/2-76-113 August 75 to October 75
R-001-76 to R-035-76	EPA-600/2-76-185 November 75 to January 76
R-124-76 to R-175-76	August 76 to October 76
R-001-77 to R-022-77	November 76 to January 77
R-023-77 to R- -77	February 77 to April 77

A. OIL POLLUTION DETECTION AND EVALUATON

1. MONITORING

R-124-76 (renewal)
LIGHT HYDROCARBONS - OCS
Principal Investigator: Cline, J. D.
Performing Organization: U.S. Department of Commerce, Environmental Research Labs, Boulder, CO 80302

Supporting Agency: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Research Laboratories. No. R7120841
Period: 6/76 to 9/76
Funds: $37,200

The project objective is to determine the temporal and spatial distributions of the low molecular weight hydrocarbons, C_1-C_4, on the outer continental shelf of Alaska.

[SSIE No. GUK-65-1]

R-126-76 (renewal)
PHYTOPLANKTON - OCS
Principal Investigator: Larrance, J. D.
Performing Organization: U.S. Department of Commerce, Environmental Research Labs, Boulder, CO 80302
Supporting Agency: U.S. Department of the Interior, Bureau of Land Management. No. R7120844
Period: 7/76 to 9/76
Funds: $53,900

The project objective is to provide a phytoplankton baseline in northern Gulf of Alaska for the outer continental shelf studies. Sampling and analysis of phytoplankton are in progress.

[SSIE No. GUK-70-1]

R-023-77
FISH EGGS AND LARVAE STUDIES
Principal Investigators: Kendall, A. W., F. W. Barvenik, and D. Judkins
Performing Organization: Brookhaven National Laboratory, Upton, NY 11973
Supporting Agency: U.S. Energy Research and Development Administration, Biomedical and Environmental Research Division. Contract E(30-1)-16
Period: 7/75 to 6/76

A number of energy-related developments, i.e. nuclear plants, oil fields, and supertanker facilities, are planned or contemplated for the continental shelf and coastal regions of the U.S. Since fish eggs and larvae are particularly susceptible to damage by oil pollution, entrainment in power plant heat exchangers, and by limitation of food supply, a study of the seasonal and spatial distribution, abundance, and condition of ichthyoplankton stocks in the New York Bight is planned.

[SSIE No. ZPE-11112-1]

R-024-77

DISTRIBUTION OF HYDROCARBONS IN NARRAGANSETT BAY SEDIMENTS

Principal Investigator: Quinn, J. G.

Performing Organization: University of Rhode Island, School of Oceanography, Kingston, RI 02881

Supporting Agency: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Sea Grant Office. Grant No. 04-6-158-44085

Period: 7/76 to 6/78

The qualitative and quantitative distribution of hydrocarbons in Narragansett Bay sediment cores is being investigated. Information obtained will help provi[illegible] firm basis to evaluate current petroleum-related activiti[illegible]n the Bay, and will serve as a baseline on which decisions [illegible]cerning future uses can be made.

[Sea Grant Project Summary, National Sea Grant Program]

2. REMOTE SENSING

R-005-77

MAINTENANCE FOR THE AIRBORNE OIL SURVEILLANCE SYSTEM (AOSS)

Principal Investigator: Unknown

Performing Organization: Aerojet General Corporation, 9236 E. Hall Rd., Downey, CA 90241

Supporting Agency: U.S. Department of Transportation, Coast Guard

Period: 7/75 to 6/76

The contract provides for (1) advice and assistance in the operation and maintenance of the AOSS; (2) system and subsystem performance evaluation; (3) adjustment, alignment, test and checkout of the system; (4) troubleshooting and field repair.

[SSIE No. GZ-58334-1]

Status: Evaluation of a U.S. Coast Guard prototype operational airborne coastal patrol system has been completed. The system has proven effective for detection, monitoring, and assessment of offshore oil discharges; search and rescue operations; ice reconnaisance; and monitoring of foreign fishing activities in coastal waters. The Coast Guard contracted with Aerojet ElectroSystems Company to modify the sensor equipment for installation into a C-130 aircraft for operational deployment. Active operations using the modified system were scheduled to begin in January, 1977.

Reports and Publications

DEVELOPMENT OF U.S. COAST GUARD PROTOTYPE AIRBORNE OIL SURVEILLANCE SYSTEM
Ketchel, R. J. and A. T. Edgerton. 1973.
Prevention and Control of Oil Spills. Proceedings of Joint Conference on Prevention and Control of Oil Spills, Washington, D. C., 1973. p. 127-137.

Multispectral sensors, operating from the UV to the microwave region of the electromagnetic spectrum, will form the system for day/night all-weather airborne monitoring of oil spills at sea. Aerojet Electrosystems Company is the designer.

FLIGHT EVALUATION OF U.S. COAST GUARD AIRBORNE OIL SURVEILLANCE SYSTEM
Maurer, A., and A. T. Edgerton. 1975.
Conference on Prevention and Control of Oil Pollution, San Francisco, 1975. p. 129-141.

The multi-sensor airborne system has the capabilities of detecting, mapping and documenting oil spills at sea in all kinds of weather and at all times of day. The surveillance data gathered during the test were from natural seeps, controlled oil spills and routine shipping. Testing revealed each sensor to be "blind" under certain environmental conditions, reaffirming the necessity of a multisensor system.

U.S. COAST GUARD AIRBORNE OIL SURVEILLANCE SYSTEM STATUS REPORT
Maurer, A. T., A. T. Edgerton, and D. C. Meeks. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), New Orleans, March 8-10, 1977. p. 215-220. (American Petroleum Institute No. 4284)

This paper describes (1) results of prototype operational evaluation, (2) operational configuration of the C-130 aircraft, in which the sensor equipment will be installed for deployment, and (3) future plans for the system.

Information Source: A. T. Edgerton, Aerojet Electrosystems
Company, 1100 W. Hollyvale St., Azusa, CA
91702

3. ANALYSIS

R-025-77

PHYSICO-CHEMICAL REACTIONS OF METALS IN PETROLEUM WITH BEACH SEDIMENT

Principal Investigator: Rule, J. H.
Performing Organization: University of Tennessee, School of Liberal Arts, W. Cumberland Ave., S.W. Knoxville, TN 37916
Supporting Agency: U.S. National Science Foundation, Division of Advanced Environmental Research and Technology. No. ENV76-18817
Period: 6/76 to 6/77
Funds: $56,300

Certain physical-chemical relations between crude oil and beach sediment are being studied. Emphasis is on partitioning of heavy metals between oil and sediment. This study will be based on analysis of natural materials collected from beaches along the Straits of Magellan, Chile - the site of the 1974 grounding of the Tanker "Metula" which spilled nearly 68 million liters (18 million gallons) of crude oil.

B. OIL POLLUTION PREVENTION AND CONTROL

1. CONTAINMENT

R-026-77
OIL SLICK CONTROL IN OFFSHORE ENVIRONMENTS
Principal Investigator: Milgram, J. H.
Performing Organization: Massachusetts Institute of Technology, School of Engineering, 77 Massachusetts Ave., Cambridge, MA 02139
Supporting Agency: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Sea Grant Office. No. R/PO-1.
Period: 7/75 to 6/77
Funds: $20,700

Project objectives are (1) to explore by means of laboratory experiments the relative importance of turbulence on formation of polluting oil droplets by tearing them from the bottom of a contained oil slick, and (2) to devise logistical plans for oil slick control and cleanup in currents and waves typical of offshore environments.

[SSIE No. GBP-2379]

Status: A precision flume for studying oil pollution hydrodynamics, the first facility of this kind known to exist, has been made operational. The mass transport of oil by ocean waves has been determined, both theoretically and experimentally, and has been found to be different from the values in the past for predicting oil slick movements.

2. CLEANUP AND RECOVERY

R-027-77
OIL SPILL EQUIPMENT AND OIL BEHAVIOR IN COLD REGIONS
Principal Investigators: Deslauriers, P. C., and L. A. Schultz
Performing Organization: Arctec, Incorporated, 9104 Red Branch Rd., Columbia, MD 21045
Supporting Agency: U.S. Environmental Protection Agency
Period: Unknown (completed)

Reports and Publications

A COLD REGION OIL POLLUTION BIBLIOGRAPHY
Arctec, Incorporated. 1976.

The bibliography covers the following areas of aquatic and terrestrial oil pollution: containment, recovery, transfer, storage, disposal, and oil pollution sensing for cold regions; burning slicks in cold regions; biodegradation of oil; and interaction of oil pollutants with snow and ice environment.

OIL SPILL EQUIPMENT AND OIL BEHAVIOR IN COLD REGIONS
Deslauriers, P. C., and L. A. Schultz. 1977.
Final report, available from NTIS.

Summary not available.

THE APPLICATION OF EXISTING OIL SPILL ABATEMENT EQUIPMENT TO COLD REGIONS
Schultz, L. A., and P. C. Deslauriers. 1977.
1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup), March 8-10, 1977. p. 309-312. (American Petroleum Institute No. 4284)

A recently completed survey study included a review and cursory evaluation of oil spill response techniques and equipment currently used in warmer climates for application in the more severe environmental conditions of the Arctic. The survey revealed that while a very limited degree of oil spill response capability exists for use in cold regions, a great deal of development work must be undertaken before a total cold regions oil response capability will be available.

Information Source: P. C. Deslauriers, Arctec, Inc., 9104 Red Branch Rd., Columbia, MD 21045

3. OIL TRANSFER AND TRANSPORT

R-028-77
PETROLEUM - TRANSPORTATION - ENVIRONMENTAL
Principal Investigator: Lifson, W. E.
Performing Organization: Exxon Research and Engineering Co., P.O. Box 101, Florham Park, NJ 07932
Supporting Agency: Exxon Corporation
Period: 7/75 to 6/76

The contract provides for research and development of processes, equipment, and techniques to monitor, prevent, and alleviate potential environmental degradation resulting from oil transportation.

[SSIE No. CA-702-1]

4. WASTEWATER TREATMENT AND DISPOSAL METHODS

R-211-74 (renewal)
BILGE AND BALLAST WATER OIL POLLUTION CONTROL TECHNOLOGY FOR NAVAL SHIPS
Principal Investigator: Yu, T. S.
Performing Organization: U.S. Navy, Ship Research and Development Center, Annapolis, MD 21402
Supporting Agency: U.S. Department of Defense, Navy. No. DN710112
Period: 10/76 to 9/77

The following approaches for the near-term phases of the project will be applied: development of materials and technology (using both physical and chemical means) to enhance oil-detergent-water-separation, improvement of oil-water monitoring and measuring techniques, and search for a new cleaning agent formulation which will not produce stabilized emulsion.

[SSIE No. ZQN-710112-6]

R-281-75 (renewal)
SEPARATION OF EMULSIFIED OIL FROM WATER THROUGH IMPROVED MECHANICAL DEVICE
Principal Investigators: Gloyna, E. F., and C. Wu
Performing Organization: University of Texas, School of Engineering, 200 W. 21 St., Austin, TX 78712
Supporting Agency: University of Texas
Period: 7/75 to 6/76

The objective of the research is to design, construct, and evaluate devices for removing emulsified oil from oily wastewater. This work is aimed at evaluating the operational characteristics of these mechanical devices.

[SSIE No. HTX-774]

Status: A new report entitled, "Separation of Free Oil from Water Following Coalescence", will be released shortly.

Reports and Publications

COALESCENCE OF EMULSIFIED WASTES BY FIBROUS BED
Chiou, J. R., R. S. Schechter, H. J. Humenick, and E. F. Gloyna. 1975.
Texas University at Austin, Center for Research in Water Resources; Technical report CRWR-126. 183p.

The feasibility of using a fibrous bed coalescer to separate emulsified oil from industrial waste streams and to evaluate system parameters was determined. Several types of coalescing media were used and four types of oily wastes were tested to determine the effect of fluid properties. Contact angle, interfacial tension and oil viscosity were measured for each system and the results were compared with the coalescer efficiency.

HIGH RATE FILTRATION OF SOLIDS-STABILIZED OIL-IN-WATER EMULSIONS
Humenick, M. J., E. F. Gloyna and B. J. Davis. 1973.
Texas University at Austin, Center for Research in Water Resources; Technical report CRWR-105. 166p.

The performance of a high rate filtration process in removing suspended solids and oil in solids-stabilized oil-in-water emulsions was evaluated. Literature pertaining to the filtration theory and operation is reviewed.

Information Source: H. Haynes, University of Texas at Austin,
Center for Research in Water Resources,
Route 4, Box 189, Austin, TX 78757

R-029-77
LAND APPLICATION OF INDUSTRIAL WASTES
Principal Investigators: Overcash, M. R., and P. W. Westerman
Performing Organization: University of North Carolina, School of Agriculture and Life Sciences, Raleigh, VA 27607
Supporting Agency: U.S. Department of the Interior, Office of Water Research and Technology. No. B-100-NC
Period: 7/76 to 6/77
Funds: $33,468

The proposal objectives are: (1) to coordinate available fundamental and field scale information with actual treatment mechanisms and calculations to determine land loading rates for wastewater constituents of several industry categories (textiles, seafood processing, and petroleum refining); (2) to optimize the end-of-the-pipe data of objective (1) by including pretreatment unit processes which precede the plant-soil receiver so that minimum cost is achieved for the total system and maximum advantage is gained from the land receiver."

C. EFFECTS OF OIL POLLUTION

1. BIOLOGICAL EFFECTS

R-103-74
EFFECT OF DIESEL OIL ON STREAM LIFE
Principal Investigator: Patterson, R. R.
Performing Organization: State Department of Game & Fish,
Santa Fe, NM 87503
Supporting Agency: U.S. Department of the Interior,
Bureau of Sport Fish & Wildlife,
Federal Aid Division,
No. F-22-R-15-B-2
Period: 4/73 to 3/74

The project will determine repopulation rates of invertebrates and brown trout in a region of the Cimarron River heavily affected by diesel oil spillage.

[SSIE No.: GUN-11137]

Reports and Publications

EFFECT OF DIESEL OIL ON STREAM LIFE
Patterson, R. R. 1976.
Final report, Statewide Fisheries Investigations.
Federal Aid Project F-22-R-17, Job No. B-2. 14 p.

Results of three years of sampling the Cimarron River after an oil spill decimated invertebrate and brown trout, Salmo trutta, populations in 19 km (12 mi) of river indicated that invertebrate populations had essentially recovered to prespill levels in one year. The brown trout population increased to about 54% of prespill numbers in three years.

Information Source: R. R. Patterson, State of New Mexico,
Department of Game and Fish, Santa
Fe, NM 87503

R-46-76 (renewal)
EVALUATION OF THE ACUTE TOXICITY OF SECONDARILY TREATED OIL REFINERY EFFLUENTS TO FISH
Principal Investigators: Burks, S. L., and T. C. Dorris

Performing Organization: Oklahoma State University,
Reservoir Research Center,
Life Sciences W., Stillwater,
OK 74074
Supporting Agency: Oklahoma Oil Ref. Waste Cont.
Period: 7/75 to 6/76

On-site toxicity evaluations of oil refinery effluents were made with the use of a mobile bioassay laboratory trailer equipped for performance of static and continuous-flow bioassays.

[SSIE No. CH-122]

R-030-77
FUNDAMENTAL ANALYSIS TO ENABLE DETERMINATION OF EFFECTS OF OIL POLLUTION
Principal Investigators: Glynn, P. W., C. Birkeland,
A. A. Reimer, and J. R. Young
Performing Organization: U.S. Environmental Protection
Agency, 401 M St., S.W.,
Washington, D.C. 20460
Supporting Agency: Smithsonian Institution Tropical
Research Institute (STRI),
Contract No. 14-12-874
Period: 7/75 to 6/76

The STRI proposes to engage in a program which will lay the basework for evaluating the biological costs of future oil spills on tropical and related ecosystems. The roles of several natural agents of oil pollution abatement will be examined.

[SSIE No. GTA-64-4]

Reports and Publications

SURVEY OF MARINE COMMUNITIES IN PANAMA AND EXPERIMENTS WITH OIL
Birkeland, C., A. A. Reimer, and J. R. Young. 1976.
Report EPA-600/3-76-028, Contract No. 14-12-874. 175 p.

Effects of oil pollution on tropical intertidal marine communities were tested by controlled experiments using tarry Bunker C and volatile marine diesel oils. Bunker C had a greater detrimental effect [illegible]n did marine diesel on coral growth. Marine diesel had a greater detrimental effect on fouling communities of settling plates. Susceptibility to oil pollution varied significantly between individuals.

Information Source: P. W. Glynn, P. O. Box 2072, Balboa,
Canal Zone

R-031-77

EFFECTS OF MIXED PETROLEUM HYDROCARBONS IN MARINE FISHES

Principal Investigators: Stegeman, J. J., and D. J. Sabo
Performing Organization: Woods Hole Oceanographic Institution, Main St., Woods Hole, MA 02543
Supporting Agency: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Sea Grant Office No. R/B 5
Period: 7/75 to 6/77
Funds: $85,000

The following areas of research will be determined: the nature and effects of low levels of petroleum hydrocarbons on enzymatic processes related to drug or hydrocarbon, hormone, protein, carbohydrate and lipid metabolism; the significance of related cellular and ultrastructural changes; how time-dosage relationships and routes of hydrocarbon introduction alter the above effects, and whether these can be reversed by transferring contaminated fish to uncontaminated water; the characteristics of the hydrocarbon metabolizing system in marine fish.

[SSIE No. GBP-2481]

Status: The project is ongoing. Several manuscripts are in preparation.

Reports and Publications

ELECTRON PARAMAGNETIC RESONANCE STUDIES OF HEPATIC MICROSOMAL CYTOCHROME P-450 FROM A MARINE TELEOST FISH
Chevion, M., J. J. Stegeman, J. Peisach, and W. E. Blumberg. 1977.
Life Sciences Vol. 20 (in press).

ASPECTS OF THE METABOLISM OF PETROLEUM HYDROCARBONS ON INTERMEDIARY METABOLISM AND XENOBIOTIC METABOLISM IN MARINE FISH
Stegeman, J. J., and D. J. Sabo. 1976.
Sources, Effects & Sinks of Hydrocarbons in the

Aquatic Environment. American Institute of Biological Sciences, 1976. p. 423-436. Proceedings of the Symposium, Washington, D. C., 1976.

In the title study, metabolic function in tissues of fish exposed to low levels of petroleum contamination is described. Petroleum hydrocarbons resulted in altered patterns of lipid metabolism characterized by a net decline in lipogenesis in the hepatic, gill, muscle, and brain tissues. Some evidence suggests that induction of mixed-function oxidases occurs in fish environmentally contaminated by petroleum.

SEX DIFFERENCES IN HEPATIC MICROSOMAL CYTOCHROME P-450 IN SPAWNING TROUT
Stegeman, J. J. 1977.
Federation Proceedings (in press)

Information source: J. J. Stegeman, Woods Hole Oceanographic Institution, Woods Hole, MA 02543

R-032-77

XENOBIOTIC (HYDROCARBON) METABOLISM BY MIXED FUNCTION OXIDASES IN ESTUARINE, COASTAL AND OPEN OCEAN FISH SPECIES

Principal Investigator: Stegeman, J. J.
Performing Organization: Woods Hole Oceanographic Institution, Woods Hole, MA 02543
Supporting Agency: National Science Foundation
Period: 3/77 to 2/78

Some factors potentially contributing to the variability noticed in hepatic mixed-function oxidase activity in estuarine and coastal fish species will be investigated. Factors will include sex, size, season, nutritional deprivation, and chemical environment, and will be examined in experimental and environmental samples. A variety of coastal water and open ocean pelagic and mesopelagic species from an area with the lowest levels of hydrocarbon contamination will be surveyed for relative ability to metabolize hydrocarbons. Results will expand what is known of the association between environmental contamination and the response of hepatic mixed-function oxidases in fish to such contamination, and provide information needed to assess the validity of using levels of these enzymes as indicators of biological effects.

[J. Stegeman, Woods Hole Oceanographic Institution, Woods Hole, MA 02543]

R-033-77
HYDROCARBON CONCENTRATION IN FOOD CHAINS
Principal Investigator: Whelan, T.
Performing Organization: Louisiana State University,
Center for Wetland Resources,
University Station, Baton Rouge,
LA 70803
Supporting Agency: U.S. Department of Commerce,
National Oceanic and Atmospheric
Administration, Sea Grant Office,
No. R/HSE-1
Period: 7/75 to 3/76

Hydrocarbon concentrations were determined in tissues of several resident marine organisms at different trophic levels in a chronically contaminated oil field environment. The geographic limits of petroleum contamination to resident marine organisms were established, based upon levels of petroleum in surrounding sediments and waters.

[SSIE No. GDP-2529]

Status: Seasonal and climatic concentrations of hydrocarbon-related compounds in water bodies of natural and oil-contaminated areas have been determined. Oil field waters contain 30% to 50% more dissolved organic carbon than control sites. The alkane and aromatic fractions of surface sediments from the oil field stations indicate substantial petroleum derived compounds. Other extractable sedimentary constituents show no quantitative or qualitative differences between oil field and natural sediments.

Reports and Publications

THE DEPARTMENT OF THE INTERIOR'S OUTER CONTINENTAL SHELF LEASING PROGRAM
Whelan, J. 1976.
Bureau of Land Management's Environmental Studies Program for the South Atlantic Outer Continental Shelf Area, Conference/Workshop Proceedings. M. F. Massoglia (compiler). Research Triangle Park, N. C., Research Triangle Institute, 1976. p. 11-14. Held at Atlanta, Georgia, 1975.

USDI responsibilities in developing and managing OCS oil and mineral resources are outlined. They include the orderly development of such resources, receipt of fair market value for the leased mineral resources, and protection of the marine coastal environment.

Information Source: T. Whelan, Louisiana State University,
Center for Wetland Resources, Baton
Rouge, LA 70803

2. CHEMICAL EFFECTS

R-034-77
MESA-CHEMICAL
Principal Investigator: Berberian, G. A.
Performing Organization: U.S. Department of Commerce,
Environmental Research Labs,
Boulder, CO 80302
Supporting Agency: U.S. Department of Commerce,
National Oceanic and Atmospheric
Administration, Environmental
Research Labs. No. 87121402
Period: 7/76 to 9/76
Funds: $59,300

Distributions and fluxes of chemical contaminants within the New York Bight ecosystem are being investigated and the degree to which anthropogenic wastes may affect the water column, suspended sediment, and bottom sediment chemistry is bring assessed. Water quality in the apex is influenced by the Hudson River discharge, photoplankton assemblages, and anthropogunic wastes. Bottom sediments appear to be primarily affected by sewage discharge, oil pollution, and acid-iron waste dumping.

[SSIE No. ZBP-777-2]

3. GENERAL EFFECTS

R-296-75 (renewal)
ENVIRONMENTAL SUPPORT TECHNOLOGY: INTERFACE CHEMISTRY IN THE MARINE ENVIRONMENT AND ITS EFFECT ON NAVAL OPERATIONS
Principal Investigators: Garrett, W. D., and W. R. Barger
Performing Organization: U.S. Navy Research Laboratory,
Washington, D. C. 20390
Supporting Agency: U.S. Department of Defense, Navy
No. DNO 20190
Period: 10/76 to 9/77

Objectives of the project are: to enhance naval operations by chemical modification of the air-sea interface, to evaluate the role of natural, artificial and pollutant surface films on air-sea interactions, and to determine the influence of organic films on atmospheric processes. Based on laboratory, test tank, and field experiments, surface-active chemicals have been selected for use as sea markers to control oil pollution at naval ship installations.

[SSIE No. ZQN-20190-3]

R-035-77
FACTORS INFLUENCING DISTRIBUTION OF HEAVY METALS IN WATER, SEDIMENTS, AND BIOTA IN A STREAM RECEIVING DOMESTIC AND OIL REFINERY EFFLUENTS
Principal Investigator: Wilhm, J.
Performing Organization: Oklahoma State University, School of Arts and Sciences, Agriculture Hall, Stillwater, OK 74075
Supporting Agency: Oklahoma State Government
Period: 7/75 to 6/76

The contract provides for observation of the effect of environment disturbances on the distribution and concentration of heavy metals in sediments and biota.

[SSIE No. YOK-96]

Reports and Publications

EFFECTS OF HIGH DISCHARGE AND AN OIL REFINERY CLEANUP OPERATION ON HEAVY METALS IN WATER AND SEDIMENTS IN SKELETON CREEK
Hammings, H. E., and J. Wilhm. 1976.
Proceedings of the Oklahoma Academy of Sciences 56:133-138.

Heavy metal concentrations in water generally decreased exponentially with time following high stream discharge while no significant trends existed in the distribution of heavy metals in sediments. Copper concentration in water generally decreased with time while chromium, lead, and zinc exhibited peak concentrations four to eight days after the date effluents from an oil refinery cleanup were expected to enter Skeleton Creek. No significant changes in metal concentrations occurred in the sediments.

HEAVY METALS IN WATER, SEDIMENTS, AND CHIRONOMIDS IN A STREAM RECEIVING DOMESTIC AND OIL REFINERY EFFLUENTS

Namminga, H. E., and J. Wilhm.

To be published in Journal Water Pollution Control Federation

The distribution of copper, chromium, lead, and zinc in water, sediments, and chironomids in Skeleton Creek, Oklahoma were measured; and the concentrations in cool and warm seasons were compared. Copper, chromium, and zinc levels in water were higher in winter than in summer, and highest concentrations generally occurred just below the outfall. Metals in sediments were generally higher in summer than in winter and highest concentrations occurred farther downstream. Concentrations of heavy metals in chironomid larvae were two or three orders of magnitude greater than in the water, but were comparable to levels in sediments.

Information Source: J. Wilhm, Oklahoma State University,
School of Biological Sciences,
Stillwater, OK 74074

R-036-77

OIL SPILLAGE IMPACT STUDY ON WORLD WAR II TANKER SINKINGS

Principal Investigator: Kern, E. C., and D. A. Horn

Performing Organization: Massachusetts Institute of Technology, School of Engineering, 77 Massachusetts Ave., Cambridge MA 02139

Supporting Agency: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Sea Grant Office, No. R/PO-2

Period: 7/75 to 6/78

Funds: $33,500

Research is being conducted of available data on World War II tanker sinkings off the U.S. East Coast to 1) determine the identifiable impact, both short-and long-range, on the marine and coastal environment; and 2) to identify areas where more detailed and definitive environmental impact studies may be warranted. The work will ascertain whether useful data exists to improve the ability to forecast oil spill impacts.

[SSIE No. GBP-2307]

Status: The project was completed December, 1976.

Reports and Publications

IMPACT OF OIL SPILLAGE FROM WORLD WAR II TANKER SINKINGS
Campbell, B., E. Kern, and D. Horn. 1977.
Massachusetts Institute of Technology, Report MITSG 77-4. 86 p.

The overall effects of spilled oil are studied through an extensive literature and archives search of data on tankers sunk along the eastern U.S. coast during World War II. Cape Hatteras, North Carolina and its surrounding area and the Ashbury Park area of New Jersey were selected as sites for the investigation. Results indicated that effects of the oil spills, as observed by residents of the areas under examination, were negligible. In both cases, regional wildlife and economy survived with minimal difficulty.

Information Source: S. B. Hurd, M.I.T. Sea Grant
Program, 77 Massachusetts Ave.,
Cambridge, MA 02139

D. EFFECTS OF OIL EXPLORATION AND PRODUCTION

1. GENERAL EFFECTS

R-037-77
POTENTIAL INTERACTIONS BETWEEN MARINE RELATED INDUSTRY, RECREATION, AND FISHING IN THE NEW HAMPSHIRE COASTAL ZONE

Principal Investigators: Henry, W. F., and G. Durgin
Performing Organization: University of New Hampshire, Resources Development Center, Durham, NH 03824
Supporting Agency: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Sea Grant Office, No. R/ME-1
Period: 7/75 to 6/76
Funds: $29,600

Among the objectives of this program are: determine the probable onshore impacts of OCS petroleum exploration and recovery based on the Coastal Zone Input-Output Matrix, and assess the public intervention measures that can be taken to improve the relationships between costs and benefits of OCS petroleum operations and recreation industry developments. The study results will be valuable in coastal zone management work.

[SSIE No. GBP-2244]

R-038-77
IMPACT ON TEXAS WATER QUALITY OF ENERGY STRATEGIES - 1974-2000

Principal Investigator: Rohlich, G. A.
Performing Organization: State Water Quality Board, Austin, TX 78711
Supporting Agency: Texas State Government
Period: 7/74 to 12/74

The project was designed to assess the impact of meeting the future energy needs of Texas on water quality and water resources. Summaries on the water use and degradation due to several energy operations, including oil and gas production, on and off shore have been prepared based on best current practices available to minimize water pollution.

[SSIE No. YTZ-531]

R-039-77

HYDROCARBON EFFECTS ON ESTUARINE CARBON FLUX

Principal Investigator: Turner, R. E.
Performing Organization: Louisiana State University,
Center for Wetland Resources,
University Station, Baton Rouge,
LA 70803
Supporting Agency: U.S. Department of Commerce,
National Oceanographic and
Atmospheric Administration,
Sea Grant Office, No. R/HSE-4.
Period: 7/76 to 8/77

The project aim is to estimate the environmental impact of oil recovery operations on *in situ* aquatic estuarine primary production and salt marsh macrophyte productivity in Louisiana. A firm statistical design for seasonal sampling and a variety of approaches to integrating short-term and long-term effects are planned.

[SSIE No. GBP-2506]

Status: The project is on-going; work is currently involved in the field research phase. No publications have been completed at present. Funding for a third year beginning September, 1977, is anticipated.

Information Source: R. E. Turner, Center for Wetland
Resources, Louisiana State
University, Baton Rouge, LA 70803

E. FATE OF OIL IN THE ENVIRONMENT

1. BIODEGRADATION

R-059-74 (renewal)
NAVY ENVIRONMENT: BIODEGRADATION OF OIL POLLUTANTS BY YEAST AND YEAST LIKE FUNGI
Principal Investigators: Ahearn, D. G., and W. L. Cook
Performing Organization: Georgia State University, School of Arts and Sciences, 33 Gilmer St., S.E., Atlanta, GA 30303
Supporting Agency: U.S. Department of Defense, Navy. No. DN123203, Contract N00014-71-C-0145
Period: 10/76 to 9/77
Funds: $18,000

To provide a better understanding of how biological degradation takes place in the marine environment and its enhancement, the effects of oil soluble toxicants on growth and oil emulsification by yeasts are being studied. The factors necessary for optimum nutrient enrichment and oxygenation for oil degradation by yeasts are being determined. The assessment of possible toxicity of selected fungi to marine and estuarine organisms is being continued.

[SSIE No. GQN-123203-6]

Reports and Publications

MICROBIOLOGICAL CYCLING OF OIL IN ESTUARINE MARSHLANDS
Ahearn, D. G., S. A. Crow, and R. H. Berner. 1976. Estuarine Processes, Uses, Stresses, and Adaptation to the Estuary. New York, Academic Press, 1976. Vol. 1. p. 483-492.

This report examines the effects of Louisiana crude oil and a mixed culture of yeasts on the indigenous microbial flora. The hydrocarbon-utilizing bacteria and yeasts increased at sites accidentally or experimentally inundated with crude oil. Marsh sediments contained low populations of hydrocarbonoclastic fungi with few strains showing significant oil-emulsifying properties. In culture, a mixed culture of *Candida maltosa* and *C. lipolytica* gave significant emulsification of crude oil and utilized up to 90% of selected hydrocarbons.

Information Source: D. G. Ahearn, Georgia State University,
School of Arts and Sciences, 33 Gilmer
St., S.E., Atlanta, GA 30303

P-068-74 (renewal)
NAVY ENVIRONMENT-BIODEGRADATION OF OIL SLICKS IN THE MARINE ENVIRONMENT

Principal Investigator: Bartha, R.
Performing Organization: Rutgers The State University,
School of Arts and Sciences,
Old Queens Building, New
Brunswick, NJ 08903
Supporting Agency: U.S. Department of Defense,
Navy, No. DN023175, Contract
N00014-67-A-0115-0005
Period: 7/75 to 8/76
Funds: $17,981

Isolates of microorganisms from oil-soaked beaches and soil samples are being examined to obtain species that are able to grow in the oil phase of an oil-water system. The metabolic activity of the microorganisms in oil is being determined and the effect of oleophilic fertilizers on the rate of growth measured. Mutants of bacteria that utilize both normal and branched alkanes are being tested for their ability to increase petroleum degradation in seawater. Additional work concerns the effects of stimulated biodegradation on marine ecosystems.

[SSIE No. GQN-23175-7]

Status: The project terminated in August, 1976.

Reports and Publications

EFFECT OF IRON ON THE BIODEGRADATION OF PETROLEUM IN SEAWATER
Dibble, J. T., and R. Bartha. 1976.
Applied and Environmental Microbiology 31(4):544-550.

Studies on South Louisiana crude oil show ferric octoate, in combination with paraffinized urea and octylphosphate, to be suitable for treatment of oil slicks. Nitrogen and phosphorus were also shown to greatly increase biodegradation in polluted seawater.

Information Source: R. Bartha, Rutgers The State
University, School of Arts and
Sciences, Old Queens Bldg., New
Brunswick, NJ 08903

R-116-74 (renewal)
NAVY ENVIRONMENT: MICROBIAL METABOLISM OF HYDROCARBONS UNDER LOW TEMPERATURE MARINE CONDITIONS
Principal Investigators: Traxler, R. W., and A. M. Cundell
Performing Organization: University of Rhode Island,
Agricultural Experiment Station,
Administration Building, Wakefield,
RI 02881
Supporting Agency: U.S. Department of Defense, Navy,
No. 0N475025, Contract N00014-76-C-0318
Period: 10/76 to 9/77
Funds: $15,000

This study employs isolates from environments with a temperature range from -2.5 to 20°C; liquid-liquid and vapor-liquid phase culture systems are being used to measure cyclic hydrocarbon metabolism. Component analyses of the fine structure are being made to define the nature of the intracellular deposit found in hydrocarbon grown cells. Laboratory data is being compared to data from a fuel oil spill study in Narragansett Bay.
[SSIE No. GQN-475025-3]

R-216-74(renewal)
NAVY ENVIRONMENT: MICROBIAL DEGRADATION OF AROMATIC PETROLEUM PRODUCTS
Principal Investigators: Gibson, D. T., and H. J. Rohlich
Performing Organization: University of Texas, School of
Natural Sciences, 200 W. 21 St.,
Austin, TX 78712
Supporting Agency: U.S. Department of Defense, Navy,
No. 0N323091, Contract N00014-76-C-0102
Period: 10/76 to 9/77
Funds: $20,000

This work on microorganisms that preferentially attack aromatic hydrocarbons found in crude oil provides for the successful treatment of oil spills. Emphasis is placed on the pathways of degradation of these compounds by organisms that can use them for growth.

[SSIE No. GQN-323091-3]

R-299-75 (renewal)
GENETICALLY ENGINEERED MICROORGANISMS FOR ENHANCED PRODUCTION OF PROTEIN FROM PETROLEUM
Principal Investigator: Chakrabarty, A. M.
Performing Organization: General Electric Company, 1
River Rd., Schenectady, NY 12305

Supporting Agency: U.S. National Science Foundation, Division of Biological and Medical Sciences, No. BMS75-10978.
Period: 5/76 to 5/77
Funds: $30,000

A large number of aromatic and polynuclear aromatic hydrocarbon metabolizing pathways will be screened and analyzed genetically in several *Pseudomonas* species to characterize the transmissable plasmid nature of the genes specifying these pathways. Multi-plasmid single strains will be constructed to be used for enhanced production of protein from petroleum or for rapid cleanup of oil spills on rivers and lakes.

[SSIE No. GSB-16385-1]

Reports and Publications

MICROBIAL GENETIC ENGINEERING. AN EVALUATION OF BENEFITS AND BIOHAZARDS
Chakrabarty, A. M. 1977
Genetic Engineering. Cleveland, CRC Press Inc., 1977. 23 p.

Three areas of genetic engineering research are discussed by the author: oil spill cleanup, enhanced production of methane from cellulosic wastes, and functional expression of bacterial nitrogen fixation genes in plants. The reasons for the genetic development of a multi-plasmid pure culture for oil spill cleanup, the methods usud, and an assessment of biohazard potentials in using these microorganisms for this purpose are presented in Section I.

Information Source: A. M. Chakrabarty, General Electric Company, 1 River Rd., Schenectady, NY 12305

R-027-76 (renewal)
NAVY ENVIRONMENT: MICROBIAL METABOLISM OF HYDROCARBONS UNDER CONDITIONS OF EXTREME COLD
Principal Investigator: Atlas, R. M.
Performing Organization: University of Louisville, School of Arts and Sciences, 129 E. Broadway, Louisville, KY 40208
Supporting Agency: U.S. Department of Defense, Navy, No. DN475257, Contract N00014-76-C-0400
Period: 10/76 to 9/77
Funds: $15,531

Summer field work concerned with monitoring changes in microbial populations of Alaskan coastal waters exposed to petroleum hydrocarbons is being conducted along with the Naval Arctic Research Laboratory. The effects of oil on essential microbial processes (nitrogen fixation and photosynthesis) are being studied. Experiments are being done to determine if oil is degradable when the sea is frozen.

[SSIE No. GQN-475257-3]

2. GENERAL FATE OF OIL

R-155-76 (renewal)
DISTRIBUTION OF SPILLED OIL IN RELATION TO BEACH MORPHOLOGY
Principal Investigator: Hayes, M. O.
Performing Organization: University of South Carolina,
School of Arts and Sciences,
Administration Building, Rm. 115,
Columbia, SC 29208
Supporting Agency: U.S. National Science Foundation,
Division of Advanced Environmental
Research and Technology.
No. ENV76-06898-A01
Period: 12/76 to 2/77
Funds: $9,000

Research was begun on the oil-contaminated beaches of the Straits of Magellan after the 1974 Metula grounding to develop a land-form classification of these beaches and to measure the distribution of oil. Under the present grant, the beaches have been classified by types, profiles drawn, oil distribution defined, and permanent survey markers installed. This research is designed to measure the rate of erosion-deposition of sediments occurring on the beaches by revisiting the study areas six months after the original trip and re-measuring the beach profiles using the permanent survey points as reference markers.

[SSIE No. GSQ-1455-1]

R-169-76
FATE OF PETROLEUM HYDROCARBONS IN THE MARINE FOOD WEB
Principal Investigator: Lee, R. F.
Performing Organization: Skidaway Institute of
Oceanography, Savannah, GA 31406

Supporting Agency: U.S. National Science Foundation,
Division of Ocean Sciences,
No. OCE74-06283 A01
Period: 3/76 to 2/77
Funds: $57,000

The objective of the proposed research is to further the understanding of the uptake, metabolism, storage, and discharge of petroleum hydrocarbons in marine phytoplankton and zooplankton. The distribution of a hydrocarbon within tissues, induction of hydrocarbon-degrading enzymes after oil exposure, and identification of hydrocarbons by both radiolabeled and non-labeled types in petrogenic metabolites will be studied in four phyla of benthic invertebrates. Microbial degradation work will involve the addition of C-hydrocarbon to inshore and offshore water samples followed by a collection of $^{14}CO_2$ and water soluble products.

[SSIE No. GSN-1508-2]

Reports and Publications

METABOLISM OF PETROLEUM HYDROCARBONS IN MARINE SEDIMENTS
Lee, R. F. 1976.
Sources, Effects & Sinks of Hydrocarbons in the Aquatic Environment. American Institute of Biological Sciences, 1976. p. 333-344. Proceedings of the Symposium, American University, Washington, D.C., 9-11 August 1976.

Thirty-nine recent studies on the metabolism and biodegradation of petroleum hydrocarbons by benthic microbes and other marine organisms are synthesized to trace the general pathways of hydrocarbon breakdown in marine sediments.

MONITORING OF PETROLEUM HYDROCARBONS
Lee, R. F. 1976.
Manual of Methods in Aquatic Environmental Research. Part 2 - Guidelines for the Use of Biological Accumulators in Marine Pollution Monitoring. J. E. Portmann (ed.). Rome, Food and Agricultural Organization of the United Nations, 1976. p. 38-47. (FAO Fisheries Technical Paper No. 150)

Analytical studies of the uptake, bioaccumulation, and metabolism of petroleum hydrocarbons in marine animals are reviewed. The relation of these studies to the selection of marine organisms for monitoring these hydrocarbons is examined. Based on present evidence, bivalves, specifically clams, oysters and mussels, appear to be a group of animals which are suitable for monitoring purposes.

FATE OF PETROLEUM HYDROCARBONS TAKEN UP FROM FOOD AND WATER BY THE BLUE CRAB *CALLINECTES SAPIDUS*

Lee, R. F., C. Ryan, and M. L. Neuhauser. 1976. Marine Biology 37(4):363-370.

Radiolabeled aromatic and paraffinic hydrocarbons were taken up from food and water by the blue crab *Callinectes sapidus*; about 10 percent of the hydrocarbons were assimilated. More than 50 percent of the radioactivity assimilated was in the hepatopancreas. Twenty-five days after exposure, radioactivity was found only in the hepatopancreas, suggesting that this organ was the site of hydrocarbon metabolism. No evidence was found of hydrocarbon storage by any of the crab tissues.

Information Source: R. F. Lee, Skidaway Institute of
Oceanography, Savannah, GA 31406

SECTION III: CURRENT CONFERENCES

*Additional information not available at time of publication.

Jan. 17 - Feb. 27

FAO/SIDA Workshop on Aquatic Pollution in Relation to Protection of Living Resources, 5th, Manila, Philippines, 1977.
Sponsored by the Food and Agriculture Organization of the United Nations and the Swedish International Development Authority.

The theme of the workshop is entitled "Scientific and Administrative Basis for Management Measures"

Oil Pollution Related Papers

POLLUTION BY OIL
Wisaksono, W.

Various aspects of marine oil pollution in Southeast Asia are reviewed and pertinent statistics are tabulated. Included are the sources of oil from shipping and tanker accidents or discharges; the characteristics of oil and methods of identifying oil pollutants; the general fate of oil in the ocean; areas likely to be affected by spills; biological/environmental effects of oil spills and chronic oil discharges; and immediate and long-term effects of oil pollution.

OIL POLLUTION ABATEMENT
Wisaksono, W.

Presently available methods and materials for curtailing, containing, and cleaning up oil spills in the marine environment are outlined. The advantages or environmental disadvantages of each method are briefly pointed out based on experience gained in Southeast Asia and elsewhere.

FFI contact Dr. H. Naeve, Fishery Resources Officer, Fishery Resources and Environment Division, FAO Department of Fisheries. Via delle Terme di Caracalla, 00100 Rome, Italy.

Feb. 27- Pittsburgh Conference on Analytical Chemistry and Applied
Mar. 4 Spectroscopy, 28th, Cleveland, 1977.

Oil Pollution Related Papers

Session: Environmental Analysis I - Toxic substances

HYDROCARBON CONTENT OF WATER IN SIMULATED OIL SPILLS
Shaw, D. G., L. Clement, and P. J. Snarski

Oil Identification Symposium I

QUANTITATIVE EFFECTS OF WEATHERING ON GAS CHROMATOGRAMS OF OILS
Flanigan, G. A., and A. F. Bentz

QUANTITATIVE EFFECTS OF WEATHERING ON INFRARED SPECTRA OF OILS
Gronlund, W. R., C. P. Chamberlain, and A. F. Bentz

DESCRIPTIVE MEASUREMENTS OF DIFFERENCES IN FLUORESCENCE SPECTRA
Chien, Y. T., T. J. Killeen, and J. R. Jadamec

USE OF NITROGEN-SENSITIVE DETECTOR FOR OIL IDENTIFICATION
Flanigan, G. A.

CHARACTERIZATION OF SYNTHETIC FUELS BY LIQUID CHROMATOGRAPHY AND MATRIX ISOLATION SPECTROSCOPY
Wehry, E. L., G. Mamantov, E. R. Hinton, R. R. Kemmerer, R. C. Stroupe, and G. Goldstein

CHEMICAL COMPOUND TYPES IN PETROLEUM RESIDUES
McKay, J. F., P. J. Amend, T. E. Cogswell, P. M. Harnsberger, R. B. Erickson, and P. R. Latham

ANALYSIS OF PETROLEUM FROM MARINE ENVIRONMENT
Brown, C. W., R. Ahmadjian, P. F. Lynch, and F. E. Franklin

Oil Identification Symposium II

PRELIMINARY INVESTIGATIONS ON CONTINUOUS FLUORESCENCE EMISSION IDENTIFICATION OF HPLC ELUATES
Jadamec, J. R., W. A. Saner, E. Kallet, and S. Cravitt

FLUORESCENCE AND LOW-TEMPERATURE LUMINESCENCE STUDIES ON WEATHERED OILS
Eastwood, D., R. S. Hendrick, and S. H. Fortier

IMPROVED IDENTIFICATION OF OILS BY LOW-TEMPERATURE TOTAL LUMINESCENCE SPECTROSCOPY
Brownrigg, J. T., A. W. Hornig, and H. Coleman

FURTHER DEVELOPMENTS IN OIL IDENTIFICATION BY TOTAL LUMINESCENCE SPECTROSCOPY
Giering, L. P., and A. W. Hornig

COMPARISON OF FLUOROMETRIC INSTRUMENTAL TECHNIQUES APPLIED TO OIL SPILL IDENTIFICATION
Helman, D. L., and J. Macemon

FINGERPRINTING CRUDE OILS WITH LOW-TEMPERATURE DERIVATIVE FLUOROMETRY
Kolb, D. A., W. V. Miller, and K. K. Shearin

COMPUTER IDENTIFICATION OF OIL TYPES (OR SPILLS)
Pyne, C. C., and J. D. Johnson

ANALYSIS OF OILS BY FLUORESCENCE SPECTROSCOPY AND NMR
Frank, U., and M. Gruenfeld

FFI contact John Graham, Program Chairman, Koppers Company, Inc., 440 College Park Drive, Monroeville, PA 15146.

Mar. 20-25 ACS National Meeting, 173rd, New Orleans, 1977.

Oil Pollution Related Papers

Symposium on Developments in Molecular Fluorescence and Phosphorescence Analysis

Paper 27
PROGRESS IN FLUORESCENCE AND LOW TEMPERATURE LUMINESCENCE TECHNIQUES FOR OIL IDENTIFICATION
Eastwood, D., S. H. Fortier, and M. S. Hendrick

Paper 28
APPLICATION OF LUMINESCENCE FOR IDENTIFICATION OF AROMATIC MIXTURES
Hornig, A. W., J. T. Brownrigg, and L. P. Giering

General Session - Gas Chromatography

Paper 56
GAS-CHROMATOGRAPHIC MASS-SPECTROMETRIC ANALYSIS OF WATER-SOLUBLE ORGANICS IN BILGE AND BALLAST WATERS
Lysyj, I., and E. C. Russell

FFI contact A. T. Winstead, American Chemical Society, 1155 16th St. N.W., Washington, D. C. 20036.

*Mar. 26-28 Changing Seabird Populations of the North Atlantic, Aberdeen, Scotland, 1977.
Sponsored by the British Ornithologists Union; British Trust for Ornithology; Royal Society for the Protection of Birds, Seabird Group; Scottish Ornithologists Club; Wildfowl Trust

Conference topics will include the effects of human activity, oil development, and chemical pollution on seabirds.

FFI contract Chris Mead, British Trust for Ornithology, Beech Grove, Tring, Herts HP23 5NR, UK.

Mar. 27-29 National Petroleum Refiners Association Annual Meeting, 75th, San Francisco, 1977.

Oil Pollution Related Papers

Environmental Control Session

THE BP EFFLUENT TREATMENT PROCESS
Oldham, G. F.

REFINERY USE OF ROTATING BIOLOGICAL SURFACES IN WASTE WATER TREATING
Knowlton, H. E.

MEMBRANE PROCESSES FOR REFINERY EFFLUENT TREATMENT
Kremen, S. S.

Refinery Process Session

CONVERSION OF RESIDUAL OILS INTO HIGH VALUE PRODUCTS
Gould, G. D.

FFI contact National Petroleum Refiners Association, 1725 De Sales St. N.W., Washington, D.C. 20036.

Apr. 12-14 International School of Hydrocarbon Measurement, 52nd, Norman, Oklahoma, 1977.
Sponsored by the University of Oklahoma Center for Continuing Education

The purpose of the intensive 3-day seminar, which includes over 100 lectures by instructors from universities and the petroleum industry, is to provide expert instruction in the measurement and handling of hydrocarbons.

Oil Pollution Related Papers

Paper L-37
THE ROLES OF EPA & INDUSTRY IN PROTECTING OUR ENVIRONMENT
Karkalik, E. J.

Paper L-41
LEAK DETECTION ON PETROLEUM PIPELINES
Hackman, R. L.

FFI regarding published proceedings, contact Dr. Laurance S. Reid, P. O. Box 1188, Norman, OK 73070

Apr. 19-21 Annual WWEMA Industrial Pollution Conference, 5th, Atlanta, 1977.

Oil Pollution Related Papers

Session 8: Petroleum and Petrochemical Industry Case Histories

MEETING COST-EFFECTIVE DISCHARGE REQUIREMENTS WITH ORBAL SYSTEM FOR REFINERY WASTEWATER TREATMENT
Takach, H. J., and W. M. Throop

TREATMENT OF OIL REFINERY WASTEWATERS WITH GRANULAR AND POWDERED ACTIVATED CARBON
DeJohn, P., and J. P. Black

FFI contact Water & Wastewater Equipment Manufacturers Association, 7900 Westpark Dr., Suite 304, McLean, VA 22101.

Apr. 22-23 Oil spills and the Law, ALI-ABA-Course, Philadelphia, 1977. Sponsored by the American Law Institute and American Bar Association.

The course deals with legal aspects of oil spills resulting from production and transfer and transportation of oil. Discussed are regulatory schemes designed to prevent spills and their effects, as well as damage liability systems and oil spill litigation. The course refers to state and federal laws, international agreements, and possible changes in the law.

Course Program

LAWS AND REGULATIONS TO PREVENT SPILLS FROM OFFSHORE EXPLORATION AND PRODUCTION OPERATIONS AND PIPELINE TRANSPORT
Radlinski, W. A., C. C. Smith, Jr., and J. J. Zedrosser

LAWS AND CONVENTIONS TO PREVENT TANKER SPILLS
Greenberg, E. V. C. , C. R. Hallberg, and C. C. Smith, Jr.

LAWS AND REGULATIONS WITH RESPECT TO CONTAINING AND CLEANING UP OIL SPILLS
Hallberg, C. R., W. A. Radlinski, C. C. Smith, Jr., and J. J. Zedrosser

LAWS AND PRIVATE AGREEMENTS WITH RESPECT TO LIABILITY FOR OIL SPILLS
Greenberg, E. V. C., C. R. Hallberg, T. H. Kurtz, C. C. Smith, Jr., and J. T. Ward

OIL SPILLS LITIGATION: THE SANTA BARBARA EXPERIENCE
McNichols, P.

OIL SPILLS LITIGATION: PRACTICAL ASPECTS OF LITIGATING VESSEL SPILLS
Kurtz, T. H., and J. T. Ward

FFI contact Donald M. Maclay, Director, Courses of Study, ALI-ABA, 4025 Chestnut St., Philadelphia, PA 19104.

Apr. 24-27 Environmental Technology '77, Annual Technical Meeting and Equipment Exposition, 23rd, Los Angeles, 1977. Sponsored by the Institute of Environmental Sciences.

Oil Pollution Related Papers

Session A3: Management Aspects of Environmental Studies

REGULATORY THINKING AND OFFSHORE EXPLORATION
Mahmood, A., and H. M. Meadow

FFI contact Institute of Environmental Sciences, 940 East Northwest Highway, Mt. Prospect, IL 60056.

Apr. 26-27 Annual Symposium on the Analytical Chemistry of Pollutants, 7th, Lake Lanier Island, Georgia, 1977. Sponsored by EPA, University of Georgia, and Division of Analytical Chemistry and Division of Environmental Chemistry of the American Chemical Society.

Oil Pollution Related Papers

Paper 2
POLYCYCLIC AROMATIC HYDROCARBONS IN THE ENVIRONMENT: CHARACTERIZATION BY CAPILLARY GC-MS AND LOW VOLTAGE MASS SPECTROMETRY
Giger, W.

A procedure for isolating trace quantities (ppm) of polycyclic aromatic hydrocarbons (PAH) from various environmental samples is detailed. The technique utilizes a sequence of gel filtration and adsorption chromatography followed by glass capillary gas chromatography to quantitatively determine individual PAH's. Directly-coupled mass spectrometry, mass chromatography, probe distillation, and low voltage mass spectrometry are then applied to identify and describe the different PAH's.

Paper 4
ORGANIC MARKER COMPOUNDS
Hertz, H. W.

Marker compounds are useful both as indicators of the presence of a larger group of compounds, and as internal and/or external standards for the quantitation of trace level constituents in a natural sample. The applicability of this concept is illustrated by a quantitative determination of weight percent of petroleum hydrocarbons in an environmental sample.

Paper 15
THE U.S. ENVIRONMENTAL PROTECTION AGENCY PROGRAM OF ENVIRONMENTAL REMOTE SENSING FROM AIRCRAFT
Melfi, S. H.

The EPA program for environmental remote sensing is outlined and the advantages of remote sensing are pointed out. Remote sensing systems that have proven useful in this program include passive imaging techniques such as photography, thermal and multispectral scanners, and active laser systems for remote measurement of atmospheric and subaqueous contaminants. Applications of remote sensing include locating, mapping and documenting major oil spills, and guiding spill containment and cleanup efforts.

FFI contact Ms. E. McGarity, Environmental Research Laboratory, College Station Rd., Athens, GA 30601.

Apr. 25-29 International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Michigan, 1977.

Oil Pollution Related Papers

Poster Session E

Paper P106
PROTOTYPE ACTIVE SCANNER FOR NIGHTTIME OIL SPILL MAPPING AND CLASSIFICATION
Sandness, G. A., and S. B. Alles

Poster Session F

Paper P128
U.S. COAST GUARD AIRBORNE OIL SURVEILLANCE SYSTEM: STATUS REPORT
Maurer, A. T., A. T. Edgerton, and D. C. Meeks

FFI contact Dr. Jerald J. Cook, Environmental Research Institute of Michigan, P.O. Box 618, Ann Arbor, MI 48107.

*May 2-5 Annual Offshore Technology Conference, 9th, Houston, 1977.
Sponsored by American Institute of Mining, Metallurgical and Petroleum Engineers; American Association of Petroleum Geologists; American Institute of Chemical Engineers; American Society of Civil Engineers; American Society of Mechanical Engineers; Marine Technology Society; Institute of Electrical and Electronics Engineers; Society of Exploration Geophysicists; and Society of Naval Architects and Marine Engineers.

FFI contact Program Manager, Offshore Technology Conference, 6200 North Central Expressway, Dallas, TX 75206.

*May 9-12 API Refining Department Midyear Meeting, 42nd, Chicago, 1977.

FFI contact American Petroleum Institute Publications and Distribution Section, 2101 L. St. N.W., Washington, D.C. 20037.

*May 10-13 Annual Conference on Great Lakes Research, 20th, Ann Arbor, Michigan, 1977.

FFI contact Dr. Andrew Robertson, 2300 Washtenaw Ave., Ann Arbor, MI 48104

*May 16-18 Canadian Symposium on Remote Sensing, 4th, Quebec City, Quebec, 1977.

FFI contact Dr. J. Kruus, Technical Program Chairman, 4th Canadian Symposium on Remote Sensing, Canada Centre for Remote Sensing, 2464 Sheffield Rd., Ottawa, Canada.

*May 17-20 Oil Sands Symposium '77, Edmonton, Alberta, 1977.
Sponsored by the Petroleum Society of the Canadian Institute of Mining and Metallurgy.

Topics include environmental aspects of oil sands extraction and production.

FFI contact D. A. Redford, Oil Sands Symposium '77, c/o Alberta Research Council, 11315 87th Ave., Edmonton, Alberta, Canada.

*May 29-June 1 Joint Conference of the American Chemical Society and the Chemical Institute of Canada, Montreal, Quebec, 1977.

FFI contact M. W. Kirkwood, Du Pont of Canada, Ltd., P.O. Box 660, Montreal, Quebec H3C 2V1, Canada.

Master List of Keywords

S: See
SA: See also

Absorption
Activated sludge
Acute effects
Adriatic Sea
Adsorption
Aegean Sea
Africa
Alaska
Alaska coast
Alaska, Gulf of
Algae ... SA: Phytoplankton
Analytical techniques ...
  SA: Chemical analysis; Source
  identification
Animals
Annelids ... SA: Polychaetes
Antarctica
API
Arabian Sea
Arctic
Arctic Ocean
Argentina
Argo Merchant Spill
Aromatic hydrocarbons ...
  SA: Hydrocarbons; PAH
Asia
Atlantic coast
Atlantic Ocean
Australia
Bacteria
Bahamas
Ballast
Baltic Sea
Bantry Bay
Barent Sea
Beaches
Beaufort Sea
Behavior
Belgium
Bengal, Bay of
Benthos
Bering Sea
Bermuda coast
Bibliographies
Bilges
Biodegradation
Biological effects ... SA:
  Toxicity; Acute effects;
  Chronic effects
Biomass
Birds
Biscay, Bay of
Black Sea
BLM
Blowout prevention
Booms
Brazil
California
California coast
California, Southern
Canada
Carcinogens ... SA: Health hazards; PAH
Caribbean Sea
Caspian Sea
Chedabucto Bay
Chemical analysis ... SA: Analytical
  techniques; Source identification
Chemical effects
Chesapeake Bay
Chile
China
Chromatography
Chronic effects
Cleanup ... SA: Recovery; Containment
Coagulation
Coalescence
Coasts
Colorado
Compensation
Connecticut
Conservation
Containment
Contaminants
Contamination
Contingency planning
Coral reefs
Cost analysis
Crankcase oil
Crude oil
Crustaceans
Decomposition
Delaware

Delaware Bay
Denmark
Design and engineering
Detection ... SA: Monitoring; Chemical analysis
Development ... SA: Offshore development
Dispersants
Dispersions
Disposal ... SA: Waste oil disposal; Wastewater disposal
Distillation
Distribution
Drift ... SA: Movement; Spreading
Drilling ... SA: Offshore drilling; Oil wells
East China Sea
Echinoderms
Economic effects
Economics
Ecosystems
Ecuador
Effluent treatment ... S: Wastewater treatment
EIS
Emulsification
Emulsifiers
Emulsions
Engineering ... S: Design and engineering
England
English Channel
Environmental deterioration
Environmental effects
Environmental Impact Statement ... S: EIS
Environmental management
Environmental protection
EPA
ERDA
Europe
Evaporation
Exploration ... SA: Offshore exploration; Production
Extraction
Fate
FEA
Filtration ... SA: Flocculation
Finland
Fish
Fisheries
Flocculation ... SA: Filtration
Florida
Florida coast
Flotation
Food web
Foreign governments
Fossil fuels
France
Freshwater
Fuel oil
Fuels
Fungi
Gas, liquid chromatography ... S: Chromatography
Gasoline
Georgia
Germany, East
Germany, West
Gibraltar, Strait of
Government agencies ... SA: U.S. Government, State governments
Great Lakes
Groundwater
Guidelines ... SA: Manuals
Habitat
Harbors
Health hazards ... SA: Carcinogens
Hydrocarbons ... SA: Aromatic hydrocarbons; Crude oil, PAH
IMCO
Incineration
India
Indian Ocean
Indonesia
Industries ... SA: Oil industry
Information systems
Infrared spectroscopy ... S: Spectroscopy
Inland
Insurance
International agreements
International conventions ... SA: Regulations; Legislation
Intertidal zone
Invertebrates
Iran
Iraq
Ireland
Israel
Italy
Japan

Japan, Sea of
Korea
Kuwait
Labrador Sea
Lakes ... SA: Great Lakes
Latin America
Law enforcement
Leakage
Legislation ... SA: Regulations; International conventions
Liability
Louisiana
Lubricating oil
Magellan, Strait of
Maine
Malaysia
Manuals ... SA: Guidelines
Marine mammals
Marine organisms
Marshes
Maryland
Massachusetts
Mass spectroscopy ... S: Spectroscopy
Mediterranean Sea
Metabolism
Metula spill
Mexico
Mexico, Gulf of
Microorganisms ... SA: Algae; Bacteria; Fungi; Yeasts
Middle East
Mississippi River
Models
Mollusks
Monitoring ... SA: Detection; Remote sensing; Sampling
Movement ... SA: Spreading; Drift
Narraganset Bay
Natural seepage
Netherlands
Neuston
New Hampshire
New Jersey
New Mexico
New York
Niche
North Carolina
North Sea
North Vietnam
Norway
Norwegian Sea
Oceans
OCS
Offshore development
Offshore drilling
Offshore exploration
Offshore pipelines
Offshore production
Ohio
Oil ... S: Crude oil; Fuel oil; Lubricating oil, Crankcase oil; Waste oil
Oil discharges
Oil fields ... SA: Production
Oil-gas leasing
Oil industry
Oil shale
Oil slicks
Oil spills
Oil tanks
Oil transfer
Oil transport
Oil-water separation ... SA: Wastewater treatment
Oil wells ... SA: Drilling; Production; Offshore drilling, Offshore production
Okhotsk, Sea of
Onshore impacts
Oregon
Oxidation ... SA: Biodegradation; Weathering
Pacific Ocean
PAH
Patent
Pennsylvania
Personnel training
Petroleum ... S: Crude oil
Petroleum products
Petrochemicals
Petroleum industry ... S: Oil industry
pH control
Philippines
Physical effects
Phytoplankton
Pipelines ... SA: Offshore pipelines
Plankton ... SA: Phytoplankton; Zooplankton
Plants
Platforms
Pollution control

Pollution prevention ... SA: Environmental protection; Contingency planning
Polychaetes
Ports
Portugal
Precipitation
Production ... SA: Offshore production; Drilling; Offshore drilling
Prudhoe Bay
Puerto Rico
Puget Sound
Reclamation ... SA: Recyling; Reuse
Recovery ... SA: Cleanup
Recycling ... SA: Reclamation; Reuse
Red Sea
Refineries
Refining
Regulations ... SA: Legislation; International conventions
Release
Remote Sensing ... SA: Monitoring; Detection
Resource management
Restoration
Reuse ... SA: Reclamation; Recycling
Rhine River
Rhode Island
Rivers
Ross Sea
Safety
Sampling ... SA: Monitoring; Detection
San Francisco Bay
Santa Barbara Channel
Sargasso Sea
Saudi Arabia
Scotland
Seawater
Sedimentation
Sediments
Segregated ballast
Ships ... SA: Tankers
Shorelines
Sinking agents
Skimmers
Sludge
Social effects
Socio-economic effects
Soil
Solid wastes
Solubility
Solution
Solvents
Source identification
South Africa
South Carolina
South China Sea
Spain
Spectrometry
Spectroscopy
Spreading ... SA: Movement; Drift
St. Lawrence River
Standing Crop
State Governments ... SA: U.S. Government; Government agencies
Statistical analysis
Statistics
Storage
Streams
Superports ... S: Ports
Supertankers ... S: Tankers
Surfactants
Surveillance
Sweden
Syria
Tankers ... SA: Ships
Tar
Tar sands
Texas
Torrey Canyon
Toxicity ... SA: Biological effects
Tropical regions
Turkey
UK
Uptake
U.S.
USCG
U.S. Government ... SA: State governments; Government agencies
USGS
USSR
Vegetation
Venezuela
Vietnam
Virginia
Virgin Islands
Wales
Washington
Waste oil

Waste oil disposal ... SA: Disposal
Waste oil treatment
Wastewaters
Wastewater disposal ... SA: Disposal
Wastewater treatment
Water quality

SUBJECT INDEX

THE SUBJECT INDEX IS A PERMUTED INDEX THAT LISTS ALPHABETICALLY THE KEYWORDS AND CORRESPONDING CITATION NUMBER ASSIGNED TO EACH ABSTRACT IN SECTION I. EACH INDEX NUMBER APPEARS IN THE FORM [illegible]. THESE KEYWORDS ARE SELECTED FROM THE MASTER LIST. [illegible] FREE LANGUAGE TERMS WHICH ARE INCLUDED TO GIVE MORE SPECIFIC INFORMATION ABOUT AN ENTRY ARE PRECEDED BY A * SIGN IN THE SUBJECT INDEX.

[illegible] ABSORPTION, MONITORING, OIL SLICKS, SHIPS, SOLVENTS, SPECTROSCOPY, [illegible]
[illegible] ABSORPTION, OIL SLICKS, PETROLEUM PRODUCTS, DETECTION, ANALYTICAL TECHNIQUES,
[illegible] ABSORPTION, OIL SPILLS, RECOVERY, DESIGN-ENGINEERING,
[illegible] ABSORPTION, OIL SLICKS, CLEANUP, PETROLEUM PRODUCTS, DESIGN-ENGINEERING, PATENT,
[illegible] ABSORPTION, WASTE OIL, CLEANUP, PATENT,
[illegible] ABSORPTION, OIL SPILLS, RECOVERY, RIVERS, ESTUARIES, HARBORS, DESIGN-ENGINEERING, [illegible]
*[illegible]
[illegible] ABSORPTION, OIL SPILLS, CLEANUP, SKIMMERS, BOOMS, SURFACTANTS, DESIGN-ENGINEERING, USA,
[illegible] ABSORPTION, OIL SPILLS, CLEANUP, WASTE OIL, PATENT, *METALLURGICAL FINES,
[illegible] ABSORPTION, WASTEWATER TREATMENT, OIL-WATER SEPARATION, PATENT,
[illegible] ACCUMULATION, AROMATIC HYDROCARBONS, WASTEWATERS, REFINERIES, CONTAMINATION,
MOLLUSKS, FOOD WEB, *FOOD CHAIN, [illegible]
[illegible] ACTIVATED SLUDGE, REFINERIES, WASTEWATER TREATMENT, GUIDELINES,
[illegible] ACTIVATED SLUDGE, WASTEWATER TREATMENT, REFINERIES, CONTAMINANTS, *BIOCHEMISTRY,
[illegible] ACUTE EFFECTS, MARINE ORGANISMS, CONTAMINATION, CHRONIC EFFECTS, DESIGN-ENGINEERING,
*CONTINUOUS FLOW BIOASSAY SYSTEM,
[illegible] ADSORPTION, CONTAMINANTS, PATENT, *POLYURETHANE FOAM,
[illegible] ADSORPTION, WASTEWATER TREATMENT, OIL-WATER SEPARATION, PRECIPITATION, PH CONTROL,
PATENT,
[illegible] ADSORPTION, WASTEWATER TREATMENT, OIL-WATER SEPARATION, PATENT, *POLYOLEFIN,
[illegible] ADSORPTION, WASTEWATER TREATMENT, OIL-WATER SEPARATION, *DETERGENTS,
[illegible] ADSORPTION, WASTE OIL, TREATMENT, PATENT,
[illegible] ADSORPTION, MODELS, OIL SPILLS, FATE, HYDROCARBONS, SPREADING, SOLUTION,
EMULSIFICATION, DECOMPOSITION,
[illegible] ADSORPTION, HYDROCARBONS, FATE, ESTUARIES, RIVERS, ATLANTIC COAST, PAH, BIODEGRADATION,
[illegible] AFRICA/SOUTH, CONSERVATION, BIRDS, RESTORATION, *JACKASS PENGUIN,
[illegible] AFRICA/SOUTH, BIODEGRADATION, OIL SPILLS, WASTE OIL, MICROORGANISMS, PATENT,
[illegible] ALASKA, PIPELINES, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ECONOMICS,
*TRANS-ALASKA PIPELINE,
[illegible] ALASKA, OIL SPILLS, TANKERS, ENVIRONMENTAL EFFECTS, CLEANUP, *COLD BAY,
[illegible] ALASKA, OIL SPILLS, OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, *[illegible] BAY,
[illegible] ALASKA, SAMPLING, BENTHOS, ESTUARIES, WATER QUALITY, *EPIFAUNA,
[illegible] ALASKA, OIL SPILLS, CLEANUP, ECONOMICS, TANKERS, PIPELINES, *OIL SPILL FUND,
[illegible] ALASKA, OIL TRANSPORT, ENVIRONMENTAL EFFECTS, PIPELINES, ECONOMIC EFFECTS, CALIFORNIA,
[illegible] ALASKA, CRUDE OIL, TOXICITY, CRUSTACEANS, *WATER SOLUBLE FRACTIONS, *LARVAL STAGES,
*SHRIMP, *CRABS,
[illegible] ALASKA, CRUDE OIL, BIOLOGICAL EFFECTS, SEDIMENTS, MARINE ORGANISMS, ECOSYSTEMS,
[illegible] ALASKA, CRUDE OIL, FUEL OIL, TOXICITY, MARINE ORGANISMS, FISH, INVERTEBRATES,
INTERTIDAL ZONE,
[illegible] ALASKA, OFFSHORE DEVELOPMENT, SOCIO-ECONOMIC EFFECTS, OCS,
[illegible] ALASKA, OFFSHORE DRILLING, OFFSHORE DEVELOPMENT, ENVIRONMENTAL PROTECTION,
REGULATIONS, CALIFORNIA/SOUTHERN, MEXICO/GULF OF,
[illegible] ALASKA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, MARINE MAMMALS, *BASELINE
STUDIES,
[illegible] ALASKA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, BIRDS, *BASELINE STUDIES,
[illegible] ALASKA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, BIRDS, *BASELINE STUDIES,
[illegible] ALASKA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, BIRDS, *BASELINE STUDIES,
[illegible] ALASKA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, BENTHOS, MARINE ORGANISMS,
*BEAUFORT SEA, *BERING SEA, *BASELINE STUDIES,
[illegible] ALASKA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, FISH, MOLLUSKS, HABITAT,
*BASELINE STUDIES,
[illegible] ALASKA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, PLANKTON, BENTHOS,
FISHERIES, *BASELINE STUDIES,
[illegible] ALASKA, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, OCS,
HYDROCARBONS, MARINE ORGANISMS, BIODEGRADATION,

[illegible] ALASKA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, MICROORGANISMS, HYDROCARBONS, CHEMICAL ANALYSIS, DISTRIBUTION, *BASELINE STUDIES,
[illegible] ALASKA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, BIODEGRADATION, HYDROCARBONS, DISTRIBUTION, *BASELINE STUDIES,
[illegible] ALASKA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, *BASELINE STUDIES, *PHYSICAL OCEANOGRAPHY, *METEOROLOGY,
[illegible] ALASKA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, *BASELINE STUDIES, *GEOLOGIC HAZARDS, *MARINE GEOLOGY,
[illegible] ALASKA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, *BASELINE STUDIES, *GEOLOGIC HAZARDS
[illegible] ALASKA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, ICE, ARCTIC OCEAN, *BASELINE STUDIES
[illegible] ALASKA, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, OCS, BIOLOGICAL EFFECTS, CONTAMINANTS, MONITORING, INFORMATION SYSTEMS,
[illegible] ALASKA, BIODEGRADATION, CRUDE OIL, MICROORGANISMS, ARCTIC,
[illegible] ALASKA/GULF OF, NATURAL SEEPAGE, HYDROCARBONS, CHEMICAL ANALYSIS,
[illegible] ALASKA/GULF OF, OIL SPILLS, CLEANUP, SKIMMERS, CONTAINMENT, DESIGN-ENGINEERING, COST ANALYSIS,
[illegible] ALASKA/GULF OF, MODELS, OIL SPILLS, MOVEMENT, DRIFT, OCS,
[illegible] ALGAE, HYDROCARBONS, SEDIMENTS, CHROMATOGRAPHY, MEXICO/GULF OF, MISSISSIPPI RIVER, SAMPLING,
[illegible] ALGAE, TOXICITY, FUEL OIL, CRUDE OIL, WASTE OIL, METABOLISM, BENTHOS,
[illegible] ALGAE, CRUDE OIL, TOXICITY, VEGETATION, LAKES, SUBARCTIC REGIONS,
[illegible] ALGAE, CRUDE OIL, BIOLOGICAL EFFECTS, *ANKISTRODESMUS,
[illegible] ALGAE, CRUDE OIL, *NAPHTHALENE, TOXICITY, FRESHWATER, METABOLISM, *CHLAMYDOMONAS ANGULOSA
[illegible] ANALYTICAL TECHNIQUES, MONITORING, DETECTION, WASTEWATERS, *LIGHT SCATTERING, *PARTICULATES, *OIL-IN-WATER,
[illegible] ANALYTICAL TECHNIQUES, MONITORING, CONTAMINANTS, OCEANS, HYDROCARBONS, TAR, SAMPLING, MARINE ORGANISMS,
[illegible] ANALYTICAL TECHNIQUES, ABSORPTION, OIL SLICKS, PETROLEUM PRODUCTS, DETECTION,
[illegible] ANALYTICAL TECHNIQUES, WASTEWATERS, REFINERIES, CHROMATOGRAPHY, SPECTROMETRY,
[illegible] ANALYTICAL TECHNIQUES, HYDROCARBONS, DETECTION,
[illegible] ANALYTICAL TECHNIQUES, OIL SHALE, EXTRACTION, CHROMATOGRAPHY, CONTAMINANTS, *BY-PRODUCT WATERS,
[illegible] ANALYTICAL TECHNIQUES, DRILLING, WATER QUALITY, *DRILLING MUDS,
[illegible] ANALYTICAL TECHNIQUES, SPECTROMETRY, EXTRACTION, SOLVENTS, *DETERGENTS, *OIL-IN-WATER,
[illegible] ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, OIL SPILLS, CHROMATOGRAPHY, SPECTROSCOPY, SAMPLING, USCG,
[illegible] ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, OIL SPILLS, OIL TRANSPORT, POLLUTION PREVENTION, USCG,
[illegible] ANALYTICAL TECHNIQUES, HYDROCARBONS, FATE, CHRONIC EFFECTS, CONTAMINATION, MARINE ORGANISMS, [illegible]
[illegible] ANALYTICAL TECHNIQUES, BIODEGRADATION, CRUDE OIL, HYDROCARBONS, PETROLEUM VARIETIES,
[illegible] ANALYTICAL TECHNIQUES, BIBLIOGRAPHIES, OIL SPILLS, SOURCE IDENTIFICATION, SPECTROSCOPY, SPECTROMETRY, CHROMATOGRAPHY
[illegible] ANALYTICAL TECHNIQUES, BIBLIOGRAPHIES, FUEL OIL, CARCINOGENS, PAH, PETROLEUM PRODUCTS,
[illegible] ANALYTICAL TECHNIQUES, BIBLIOGRAPHIES, PAH, SOURCES, FATE, CHROMATOGRAPHY, SPECTROSCOPY, [illegible], CRUDE OIL,
[illegible] ANIMALS, OIL TRANSPORT, PIPELINES, ENVIRONMENTAL EFFECTS, ESTUARIES, PLANTS, MONITORING, FLORIDA,
[illegible] ANIMALS, HYDROCARBONS, CONTAMINATION, CHRONIC EFFECTS, *IMMUNOLOGICAL RESPONSE,
[illegible] ANIMALS, OIL SPILLS, ARCTIC, PLANTS, USG,
[illegible] API, DISPERSANTS, OIL SPILLS, CLEANUP, ENVIRONMENTAL EFFECTS, CONTINGENCY PLANNING,
[illegible] API, FATE, OIL SPILLS, BIOLOGICAL EFFECTS, MARINE ORGANISMS,
[illegible] API, FATE, TOXICITY, OIL SPILLS, CONTAMINATION, MARINE ORGANISMS,
[illegible] ARCTIC, OIL SPILLS, CLEANUP, RECOVERY, DISPOSAL, ECOSYSTEMS,
[illegible] ARCTIC, OIL SPILLS, RECOVERY, ICE, DESIGN-ENGINEERING, CANADA, *CLEAN SWEEP,
[illegible] ARCTIC, OIL SPILLS, RECOVERY, CONTAINMENT, REMOTE SENSING, STORAGE, DISPOSAL,
[illegible] ARCTIC, CRUDE OIL, VEGETATION, BIOLOGICAL EFFECTS, OIL SPILLS, CANADA,
[illegible] ARCTIC, ANIMALS, OIL SPILLS, PLANTS, USG,
[illegible] ARCTIC, OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, BEAUFORT SEA, CANADA,
[illegible] ARCTIC, BLOWOUT PREVENTION, POLLUTION CONTROL, OFFSHORE DRILLING, BEAUFORT SEA,
[illegible] ARCTIC, EXPLORATION, PRODUCTION, ENVIRONMENTAL EFFECTS, PLANTS, WILDLIFE, OIL SPILLS, MARINE ORGANISMS,
[illegible] ARCTIC, ALASKA, BIODEGRADATION, CRUDE OIL, MICROORGANISMS,
[illegible] ARCTIC, ICE, OIL SPILLS, MOVEMENT, AERATION, OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, CANADA, *BLOWOUTS, *OIL-IN-ICE,
[illegible] ARCTIC, OIL SPILLS, FATE, CRUDE OIL, EVAPORATION, WEATHERING, SOLUTION, EMULSIFICATION, TAR,
[illegible] ARCTIC OCEAN, ALASKA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, ICE, *BASELINE STUDIES
[illegible] ARGO MERCHANT SPILL, OIL SPILLS, TANKERS, REGULATIONS, TAP, *LIBERIAN TANKERS,
[illegible] ARGO MERCHANT SPILL, OIL SPILLS, ATLANTIC COAST, TANKERS, ENVIRONMENTAL EFFECTS,
[illegible] ARGO MERCHANT SPILL, OIL SPILLS, TANKERS, CLEANUP, *OLYMPIC GAMES SPILL, [illegible] SPILL
[illegible] ARGO MERCHANT SPILL, OIL SPILLS, ATLANTIC COAST, TANKERS, ENVIRONMENTAL EFFECTS,
[illegible] ARGO MERCHANT SPILL, OIL SPILLS, ENVIRONMENTAL EFFECTS, TANKERS, CLEANUP,
[illegible] ARGO MERCHANT SPILL, MONITORING, OIL SPILLS, REMOTE SENSING, SPREADING, MOVEMENT, ATLANTIC OCEAN,
[illegible] ARGO MERCHANT SPILL, CLEANUP, OIL SPILLS, SKIMMERS, USCG,

[illegible] ARGO MERCHANT SPILL, OIL SPILLS, TANKERS, TOXICITY, FATE, HYDROCARBONS,
[illegible] ARGO MERCHANT SPILL, OIL SPILLS, TANKERS, HYDROCARBONS, FATE, TOXICITY,
[illegible] ARGO MERCHANT SPILL, OIL SPILLS, TANKERS, LAW ENFORCEMENT, REGULATIONS,
[illegible] AROMATIC HYDROCARBONS, CHEMICAL ANALYSIS, SOLUBILITY,
[illegible] AROMATIC HYDROCARBONS, CHEMICAL ANALYSIS, SOLUBILITY, ALKYLBENZENES,
[illegible] AROMATIC HYDROCARBONS, ACCUMULATION, CARCINOGENS, [illegible], CONTAMINATION,
MOLLUSCS, FOOD WEB, FOOD CHAIN, [illegible]
[illegible] AROMATIC HYDROCARBONS, BIOLOGICAL EFFECTS, FISH, [illegible], [illegible],
[illegible] AROMATIC HYDROCARBONS, MOLLUSCS, UPTAKE, RELEASE, MODIOLUS DEMISSUS, CRASSOSTREA
VIRGINICA, [illegible] SULFUR COMPOUNDS,
[illegible] AROMATIC HYDROCARBONS, TOXICITY, PETROLEUM PRODUCTS, MARINE ORGANISMS, SUBLETHAL
EFFECTS, RESPIRATION, GROWTH,
[illegible] AROMATIC HYDROCARBONS, SEAWATER, MARINE ORGANISMS, UPTAKE, RELEASE,
[illegible] AROMATIC HYDROCARBONS, BIODEGRADATION, BACTERIA, ANIMALS,
[illegible] AROMATIC HYDROCARBONS, BIODEGRADATION, PAH, CARCINOGENS, MICROORGANISMS,
[illegible] ATLANTIC COAST, ARGO MERCHANT SPILL, OIL SPILLS, TANKERS, ENVIRONMENTAL EFFECTS,
[illegible] ATLANTIC COAST, ARGO MERCHANT SPILL, OIL SPILLS, TANKERS, ENVIRONMENTAL EFFECTS,
[illegible] ATLANTIC COAST, OIL SPILLS, ESTUARIES, BIOLOGICAL EFFECTS, WEATHERING, PLANKTON,
FISH, BENTHOS,
[illegible] ATLANTIC COAST, OFFSHORE DRILLING, OCS, ENVIRONMENTAL PROTECTION, MOVEMENT,
CONTAMINANTS, SOUTHEASTERN U.S., [illegible]
[illegible] ATLANTIC COAST, OFFSHORE PRODUCTION, [illegible], ENVIRONMENTAL EFFECTS, OIL DISCHARGES,
[illegible] EFFECTS,
[illegible] ATLANTIC COAST, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS,
DELAWARE,
[illegible] ATLANTIC COAST, OIL SPILLS, OFFSHORE DEVELOPMENT, FISHERIES, ECONOMIC EFFECTS,
[illegible] ATLANTIC COAST, OFFSHORE DRILLING, BLOWOUT PREVENTION, OCS, TANKERS, OIL TRANSPORT,
OIL SPILLS, CALIFORNIA COAST, [illegible] GULF OF
[illegible] ATLANTIC COAST, ADSORPTION, HYDROCARBONS, FATE, ESTUARIES, RIVERS, PAH, BIODEGRADATION,
[illegible] ATLANTIC OCEAN, ARGO MERCHANT SPILL, MONITORING, OIL SPILLS, REMOTE SENSING,
SPREADING, MOVEMENT,
[illegible] ATLANTIC OCEAN, MONITORING, TAR, SAMPLING, DISTRIBUTION,
[illegible] ATLANTIC OCEAN, OIL SPILLS, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS, MARINE
ORGANISMS, OCS,
[illegible] ATLANTIC OCEAN, OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, OCS, MONITORING, GUIDELINES,
BLM,
[illegible] ATLANTIC OCEAN, OFFSHORE DEVELOPMENT, OCS, HYDROCARBONS, ENVIRONMENTAL DETERIORATION,
HEALTH HAZARDS,
[illegible] ATLANTIC OCEAN, OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, PLATFORMS, OCS, BLM,
[illegible] ATLANTIC OCEAN, OCS, [illegible], GEOLOGIC FRAMEWORK,
[illegible] ATLANTIC OCEAN, OIL SPILLS, OCS, OIL-GAS LEASING, FATE, ENVIRONMENTAL EFFECTS, RISK
ANALYSIS,
[illegible] ATLANTIC OCEAN, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS,
[illegible] ATLANTIC OCEAN, OFFSHORE DEVELOPMENT, SOCIO-ECONOMIC EFFECTS, ENVIRONMENTAL EFFECT,
[illegible] ATLANTIC OCEAN, BIODEGRADATION, SEEDING, MICROORGANISMS, BACTERIA, POLLUTION CONTROL,
[illegible] ATLANTIC OCEAN, BIODEGRADATION, PETROLEUM PRODUCTS, MICROORGANISMS, BARENT SEA, BALTIC
SEA,
[illegible] BACTERIA, SAMPLING, HYDROCARBONS, DISTRIBUTION, MICROORGANISMS, TAR, SEDIMENTS,
OFFSHORE DEVELOPMENT, NORTH SEA,
[illegible] BACTERIA, HYDROCARBONS, CLEANUP, OIL SPILLS, BIODEGRADATION, PATENT,
[illegible] BACTERIA, OIL SPILLS, ESTUARIES, DISTRIBUTION, MICROORGANISMS,
[illegible] BACTERIA, BIODEGRADATION, OIL SLICKS, HYDROCARBONS, CLEANUP, NUTRIENT ENRICHMENT,
[illegible] BACTERIA, BIODEGRADATION, OIL SPILLS, CLEANUP, MICROBIAL GENETIC ENGINEERING,
[illegible] BACTERIA, BIODEGRADATION, WASTE OIL, OIL SPILLS, SOIL, PETROLEUM WASTE,
[illegible] BACTERIA, BIODEGRADATION, HYDROCARBONS, OIL SLICKS, [illegible]
[illegible] BACTERIA, BIODEGRADATION, HYDROCARBONS, OIL SLICKS, COASTS, FRESHWATER,
[illegible] BACTERIA, BIODEGRADATION, HYDROCARBONS, SEDIMENTS, SEAWATER, NARRAGANSETT BAY, RHODE
ISLAND,
[illegible] BACTERIA, BIODEGRADATION, HYDROCARBONS, METABOLISM, ALICYCLIC COMPOUNDS,
[illegible] BACTERIA, BIODEGRADATION, HYDROCARBONS, MULTIPLASMID MICROORGANISMS,
[illegible] BACTERIA, AROMATIC HYDROCARBONS, BIODEGRADATION, ANIMALS,
[illegible] BACTERIA, BIODEGRADATION, PAH, MICROORGANISMS, CARCINOGENS,
[illegible] BACTERIA, ATLANTIC OCEAN, BIODEGRADATION, SEEDING, MICROORGANISMS, POLLUTION CONTROL,
[illegible] BACTERIA, BIODEGRADATION, HYDROCARBONS, SEAWATER, PARAFFINS, INORGANIC SUBSTANCES,
[illegible] BACTERIA, BIODEGRADATION, FUEL OIL, SOIL,
[illegible] BACTERIA, BIODEGRADATION, CRUDE OIL, PETROLEUM PRODUCTS, CASPIAN SEA, USSR,
[illegible] BACTERIA, BIODEGRADATION, CRUDE OIL, MONITORING, SAMPLING, TAR,
[illegible] BACTERIA, BIODEGRADATION, OIL SPILLS, SEDIMENTS, CHESAPEAKE BAY, COLGATE CREEK,
[illegible] BALLAST, MONITORING, OIL DISCHARGES, TANKERS, INSTRUMENTATION,
[illegible] BALLAST, MONITORING, CONTAMINATION, [illegible], BILGES,
[illegible] BALLAST, WASTEWATER TREATMENT, OIL-WATER SEPARATION, COALESCENCE, PATENT,
[illegible] BALLAST, WASTEWATER TREATMENT, TANKERS, [illegible]
[illegible] BALLAST, [illegible], OIL-WATER SEPARATION, POLLUTION CONTROL, OIL SPILLS,
[illegible], BILGES,
[illegible] BALTIC SEA, ATLANTIC OCEAN, BIODEGRADATION, PETROLEUM PRODUCTS, MICROORGANISMS, BARENT
SEA

0938 BARENTS SEA, BALTIC SEA, ATLANTIC OCEAN, BIODEGRADATION, PETROLEUM PRODUCTS,
    MICROORGANISMS.
0961 BEACHES, OIL SPILLS, CRUDE OIL, TANKERS, SPREADING, MOVEMENT, CLEANUP, DISPERSANTS,
    JAPAN.
0875 BEACHES, OIL SPILLS, ENVIRONMENTAL EFFECTS, MARSHES, MARINE ORGANISMS, CHESAPEAKE BAY,
0940 BEACHES, METULA SPILL, FATE, TANKERS, ENVIRONMENTAL EFFECTS, ESTUARIES, MARINE
    ORGANISMS, MAGELLAN/STRAIT OF.
0979 BEACHES, OIL SPILLS, FATE, MOVEMENT, SEDIMENTS, BIOLOGICAL EFFECTS, PLANKTON,
    BENTHOS, CHEDABUCTO BAY.
0887 BEAUFORT SEA, MONITORING, HYDROCARBONS, DISTRIBUTION, WATER QUALITY,
0919 BEAUFORT SEA, REMOTE SENSING, OIL SPILLS, *OPTICAL TECHNIQUES,
0979 BEAUFORT SEA, CONTAINMENT, OIL SLICKS, BOOMS, *ICE RIDGE KEEL,
0782 BEAUFORT SEA, CONTINGENCY PLANNING, OIL SPILLS, CLEANUP, ICE,
0877 BEAUFORT SEA, ALASKA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, BENTHOS,
    MARINE ORGANISMS, BERING SEA, *BASELINE STUDIES.
0892 BEAUFORT SEA, ARCTIC, OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, CANADA,
0900 BEAUFORT SEA, ARCTIC, BLOWOUT PREVENTION, POLLUTION CONTROL, OFFSHORE DRILLING,
0987 BEAUFORT SEA, MODELS, OIL SPILLS, DRIFT, SHORELINES, OCS, *STORM MODELING,
0764 BEHAVIOR, FUEL OIL, *KEROSENE, BIOLOGICAL EFFECTS, CRUSTACEANS, MOLLUSKS, *SUBLETHAL
    EFFECTS, *LOBSTER, *MUD SNAIL.
0755 BEHAVIOR, FISH, CONTAMINATION, BENTHOS, *BUNKER OIL, *OIL-CONTAINING FEED, *FEEDING,
0771 BEHAVIOR, FISH, *NAPHTHALENES, DISTRIBUTION, UPTAKE, RELEASE, *STRESS, *FUNDULUS
    SIMILIS.
0808 BEHAVIOR, CRUDE OIL, BIOLOGICAL EFFECTS, MOLLUSKS, SEDIMENTS, CHEMICAL ANALYSIS,
    *CLAM, *MACOMA BALTHICA.
0891 BEHAVIOR, ARCTIC, ICE, OIL SPILLS, MOVEMENT, OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS,
    CANADA, *BLOWOUTS, *OIL-IN-ICE.
0922 BEHAVIOR, OIL SPILLS, STATISTICAL ANALYSIS, WEATHERING, PIPELINES, CANADA, INLAND,
0983 BEHAVIOR, OIL SPILLS, HYDROCARBONS, GROUNDWATER, *SURFACE WATERS, *WATER-SOLUBLE
    FRACTIONS.
0976 BEHAVIOR, HYDROCARBONS, SEDIMENTS, FATE, CRUDE OIL, SOURCES, ENVIRONMENTAL EFFECTS,
0850 BELGIUM, WASTEWATER TREATMENT, REFINERIES, OIL-WATER SEPARATION,
0861 BELGIUM, WASTEWATER TREATMENT, REFINERIES, POLLUTION PREVENTION, *SURFACE WATERS,
0822 BENTHOS, ALASKA, SAMPLING, ESTUARIES, WATER QUALITY, [illegible]
0826 BENTHOS, SAMPLING, HYDROCARBONS, SEDIMENTS, UPTAKE, CHEMICAL ANALYSIS, TAR, *[illegible]
    [illegible]
0768 BENTHOS, ATLANTIC COAST, OIL SPILLS, ESTUARIES, BIOLOGICAL EFFECTS, WEATHERING,
    PLANKTON, FISH.
0755 BENTHOS, BEHAVIOR, FISH, CONTAMINATION, *BUNKER OIL, *OIL-CONTAINING FEED, *FEEDING,
0773 BENTHOS, ALGAE, TOXICITY, FUEL OIL, CRUDE OIL, WASTE OIL, METABOLISM,
0877 BENTHOS, BEAUFORT SEA, ALASKA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS,
    MARINE ORGANISMS, BERING SEA, *BASELINE STUDIES.
0878 BENTHOS, ALASKA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, PLANKTON,
    FISHERIES, *BASELINE STUDIES.
0931 BENTHOS, BIODEGRADATION, HYDROCARBONS, METABOLISM, SEDIMENTS, MICROORGANISMS, MARINE
    ORGANISMS.
0979 BENTHOS, BEACHES, OIL SPILLS, FATE, MOVEMENT, SEDIMENTS, BIOLOGICAL EFFECTS, PLANKTON,
    CHEDABUCTO BAY.
0877 BERING SEA, BENTHOS, BEAUFORT SEA, ALASKA, ENVIRONMENTAL EFFECTS, OFFSHORE
    DEVELOPMENT, OCS, MARINE ORGANISMS, *BASELINE STUDIES.
0953 BERMUDA, TAR, INTERTIDAL ZONE, MARINE ORGANISMS, BIOLOGICAL EFFECTS, HYDROCARBONS,
0832 BIBLIOGRAPHIES, OIL SPILLS, CONTAMINATION, OCEANS, ESTUARIES, BIOLOGICAL EFFECTS,
    FATE, ENVIRONMENTAL EFFECTS, MARINE ORGANISMS.
1000 BIBLIOGRAPHIES, ANALYTICAL TECHNIQUES, OIL SPILLS, SOURCE IDENTIFICATION,
    SPECTROSCOPY, SPECTROMETRY, CHROMATOGRAPHY.
1001 BIBLIOGRAPHIES, LEGISLATION, US, INTERNATIONAL AGREEMENTS, OCEANS, SHIPS, OFFSHORE
    DRILLING, POLLUTION PREVENTION, OIL SPILLS.
1002 BIBLIOGRAPHIES, ANALYTICAL TECHNIQUES, FUEL OIL, CARCINOGENS, TAR, PETROLEUM PRODUCTS,
1003 BIBLIOGRAPHIES, ANALYTICAL TECHNIQUES, TAR, SOURCES, FATE, CHROMATOGRAPHY,
    SPECTROSCOPY, CARCINOGENS, CRUDE OIL.
1004 BIBLIOGRAPHIES, BALLAST, OIL-WATER SEPARATION, POLLUTION CONTROL, OIL SPILLS,
    RECOVERY, BILGES.
0895 BILGES, BALLAST, MONITORING, CONTAMINATION, SHIPS,
0827 BILGES, MONITORING, WASTEWATER, SHIPS, OIL-WATER SEPARATION, PATENT,
0840 BILGES, WASTEWATER TREATMENT, OIL-WATER SEPARATION, FILTRATION, *TUBULAR
    ULTRAFILTRATION SYSTEM.
0701 BILGES, OIL-WATER SEPARATION, SHIPS, DESIGN-ENGINEERING, UK,
0892 BILGES, REGULATIONS, US, SHIPS, OIL TRANSFER, OIL DISCHARGES, USCG,
1004 BILGES, BIBLIOGRAPHIES, BALLAST, OIL-WATER SEPARATION, POLLUTION CONTROL, OIL SPILLS,
    RECOVERY.
0812 BIODEGRADATION, DISPERSANTS, CHEMICAL ANALYSIS, SEAWATER,
0987 BIODEGRADATION, OIL SPILLS, DISPERSANTS, CLEANUP, TOXICITY,
0951 BIODEGRADATION, DISPERSANTS, HYDROCARBONS, OIL SLICKS, CLEANUP, M TEST, *NITROGEN
    COMPOUNDS.

0594 BIODEGRADATION, DISPERSANTS, HYDROCARBONS, OIL SLICKS, CLEANUP, PATENT, *NITROGEN COMPOUNDS,
0595 BIODEGRADATION, DISPERSANTS, HYDROCARBONS, OIL SLICKS, CLEANUP, PATENT, *NITROGEN COMPOUNDS,
0605 BIODEGRADATION, BACTERIA, HYDROCARBONS, CLEANUP, OIL SPILLS, PATENT,
0611 BIODEGRADATION, RESTORATION, OIL SPILLS, SOIL, PLANTS, *FERTILIZERS,
[illegible] BIODEGRADATION, OIL SPILLS, DISPOSAL, HYDROCARBONS, [illegible], [illegible],
0626 BIODEGRADATION, OIL SPILLS, ENVIRONMENTAL EFFECTS, SOURCES, CLEANUP, RECOVERY, *BOOK REVIEW,
0660 BIODEGRADATION, ALASKA, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, OCS, HYDROCARBONS, MARINE ORGANISMS,
0662 BIODEGRADATION, ALASKA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, HYDROCARBONS, DISTRIBUTION, *BASELINE STUDIES,
0906 BIODEGRADATION, ARCTIC, ALASKA, CRUDE OIL, MICROORGANISMS,
0907 BIODEGRADATION, AFRICA/SOUTH, OIL SPILLS, WASTE OIL, MICROORGANISMS, PATENT,
0908 BIODEGRADATION, BACTERIA, OIL SLICKS, HYDROCARBONS, CLEANUP, *NUTRIENT ENRICHMENT,
0909 BIODEGRADATION, HYDROCARBONS, SOIL, OXIDATION, MICROORGANISMS, *OXYGEN UPTAKE RATE,
0910 BIODEGRADATION, BACTERIA, OIL SPILLS, CLEANUP, *MICROBIAL GENETIC ENGINEERING,
0911 BIODEGRADATION, HYDROCARBONS, MICROORGANISMS, FRESHWATER, ECOSYSTEMS,
0912 BIODEGRADATION, BACTERIA, WASTE OIL, OIL WELLS, SOIL, *PETROLEUM WASTE,
0913 BIODEGRADATION, BACTERIA, HYDROCARBONS, OIL SLICKS, [illegible],
0914 BIODEGRADATION, OIL SPILLS, SOIL, FATE, ENVIRONMENTAL EFFECTS,
0915 BIODEGRADATION, BACTERIA, HYDROCARBONS, OIL SLICKS, COASTS, FRESHWATER,
0916 BIODEGRADATION, BACTERIA, HYDROCARBONS, SEDIMENTS, SEAWATER, NARRAGANSETT BAY, RHODE ISLAND,
0917 BIODEGRADATION, BACTERIA, HYDROCARBONS, METABOLISM, *ALICYCLIC COMPOUNDS,
0918 BIODEGRADATION, WASTEWATERS, REFINERIES, RECYCLING,
0919 BIODEGRADATION, CRUDE OIL, OCEANS, MICROORGANISMS, *NUTRIENT REQUIREMENTS,
0920 BIODEGRADATION, BACTERIA, HYDROCARBONS, *MULTI-PLASMID MICROORGANISMS,
0921 BIODEGRADATION, HYDROCARBONS, OXIDATION, SOIL, BIODEGRADATION RATE,
0922 BIODEGRADATION, BACTERIA, AROMATIC HYDROCARBONS, [illegible],
0923 BIODEGRADATION, AROMATIC HYDROCARBONS, PAH, CARCINOGENS, MICROORGANISMS,
0924 BIODEGRADATION, BACTERIA, PAH, MICROORGANISMS, CARCINOGENS,
0925 BIODEGRADATION, FUELS, MICROORGANISMS, *SUPERSONIC AIRCRAFT FUEL,
0926 BIODEGRADATION, GASOLINE, GROUNDWATER, *NUTRIENT ADDITION,
0927 BIODEGRADATION, GASOLINE, GROUNDWATER, PENNSYLVANIA, *NUTRIENT ADDITION,
0928 BIODEGRADATION, ANALYTICAL TECHNIQUES, CRUDE OIL, HYDROCARBONS, *PETROLEUM VARIETIES,
0929 BIODEGRADATION, HYDROCARBONS, MICROORGANISMS,
0930 BIODEGRADATION, BACTERIA, ATLANTIC OCEAN, OXIDATION, MICROORGANISMS, POLLUTION CONTROL,
0931 BIODEGRADATION, BENTHOS, HYDROCARBONS, METABOLISM, SEDIMENTS, MICROORGANISMS, MARINE ORGANISMS,
0932 BIODEGRADATION, HYDROCARBONS, MICROORGANISMS, SEAWATER,
0933 BIODEGRADATION, BACTERIA, HYDROCARBONS, SEAWATER, *HEXADECANE, *ORGANIC SUBSTANCES,
0934 BIODEGRADATION, BACTERIA, FUEL OIL, SOIL,
0935 BIODEGRADATION, OIL SPILLS, SOIL, DECOMPOSITION, MICROORGANISMS, MODELS, *NUTRIENT DEMAND,
0936 BIODEGRADATION, BARENTS SEA, BALTIC SEA, ATLANTIC OCEAN, PETROLEUM PRODUCTS, MICROORGANISMS,
0937 BIODEGRADATION, HYDROCARBONS, METABOLISM, MICROORGANISMS,
0938 BIODEGRADATION, OIL SPILLS, MICROORGANISMS,
0939 BIODEGRADATION, FUEL OIL, MICROORGANISMS, FRESHWATER, *CONTINUOUS CULTURE,
0940 BIODEGRADATION, BACTERIA, CRUDE OIL, PETROLEUM PRODUCTS, CASPIAN SEA, USSR,
0941 BIODEGRADATION, CRUDE OIL, PETROLEUM PRODUCTS, ENVIRONMENTAL EFFECTS, MICROORGANISMS, OXIDATION,
0942 BIODEGRADATION, MICROORGANISMS, HYDROCARBONS, PETROLEUM PRODUCTS, CRUDE OIL, GROUNDWATER, USSR,
0943 BIODEGRADATION, PETROCHEMICALS, MICROORGANISMS, METABOLISM,
0944 BIODEGRADATION, HYDROCARBONS, SOIL, MONITORING, MODELS,
0945 BIODEGRADATION, CRUDE OIL, MICROORGANISMS, ESTUARIES, CHESAPEAKE BAY,
0946 BIODEGRADATION, BACTERIA, CRUDE OIL, MONITORING, SAMPLING, FATE,
0947 BIODEGRADATION, BACTERIA, OIL SPILLS, SEDIMENTS, CHESAPEAKE BAY, *COLGATE CREEK,
0948 BIODEGRADATION, HYDROCARBONS, METABOLISM, MICROORGANISMS, *MUTAGENS,
[illegible] BIODEGRADATION, OIL SPILLS, CRUDE OIL, FATE, EVAPORATION, DISPERSIONS, OXIDATION, TAR,
[illegible] BIODEGRADATION, MODELS, HYDROCARBONS, OIL SPILLS, OCEANS, FATE, SPREADING, EVAPORATION,
[illegible] BIODEGRADATION, ATLANTIC COAST, ADSORPTION, HYDROCARBONS, FATE, ESTUARIES, RIVERS, PAH,
[illegible] BIODEGRADATION, CRUDE OIL, CHEMICAL ANALYSIS, CHROMATOGRAPHY, OXIDATION, EVAPORATION, *PHOTOOXIDATION,
[illegible] BIOLOGICAL EFFECTS, OIL SPILLS, POLLUTION PREVENTION, CLEANUP, SURVEILLANCE, INTERNATIONAL AGREEMENTS,
[illegible] BIOLOGICAL EFFECTS, OIL SPILLS, MONITORING,
[illegible] BIOLOGICAL EFFECTS, CONTAMINATION, CHEMICAL ANALYSIS, CRUDE OIL, HYDROCARBONS, *WATER-SOLUBLE FRACTION,
[illegible] BIOLOGICAL EFFECTS, OIL SPILLS, CLEANUP, HARBORS, MAMMALS,
[illegible] BIOLOGICAL EFFECTS, WASTE OIL, RECYCLING, REUSE, DISPOSAL,
[illegible] BIOLOGICAL EFFECTS, FUEL OIL, BIRDS, MONITORING, REPRODUCTION,

0754 BIOLOGICAL EFFECTS, BEHAVIOR, FUEL OIL, [illegible], CRUSTACEANS, MOLLUSKS, *SUBLETHAL EFFECTS, *LOBSTER, *MUD SNAIL,
0758 BIOLOGICAL EFFECTS, BENTHOS, ATLANTIC COAST, OIL SPILLS, ESTUARIES, WEATHERING, PLANKTON, FISH,
0763 BIOLOGICAL EFFECTS, CRUDE OIL, EMULSIONS, CRUSTACEANS, *SHRIMP, *FEEDING ACTIVITIES,
0766 BIOLOGICAL EFFECTS, OIL SPILLS, RESTORATION, MARINE ORGANISMS, SAN FRANCISCO BAY,
0767 BIOLOGICAL EFFECTS, OIL SPILLS, TROPICAL REGIONS, MARINE ORGANISMS, INTERTIDAL ZONE, MARSHES, CORAL REEFS, FLORIDA COAST,
0768 BIOLOGICAL EFFECTS, CONTAMINATION, PUGET SOUND,
0770 BIOLOGICAL EFFECTS, HYDROCARBONS, BIRDS, CHEMICAL ANALYSIS, METABOLISM, FOOD WEB, *EGGS,
0771 BIOLOGICAL EFFECTS, ALASKA, CRUDE OIL, SEDIMENTS, MARINE ORGANISMS, ECOSYSTEMS,
0772 BIOLOGICAL EFFECTS, CRUDE OIL, CRUSTACEANS, *LOBSTER, *HOMARUS AMERICANUS,
0774 BIOLOGICAL EFFECTS, ARCTIC, CRUDE OIL, VEGETATION, OIL SPILLS, CANADA,
0779 BIOLOGICAL EFFECTS, CRUDE OIL, MARINE MAMMALS, METABOLISM, *SEALS,
0781 BIOLOGICAL EFFECTS, OIL SPILLS, MARSHES, MARINE ORGANISMS, MOLLUSKS, CHESAPEAKE BAY, *MARSH GRASS,
0782 BIOLOGICAL EFFECTS, OIL SPILLS, VEGETATION, MICROORGANISMS, SOIL, CANADA,
0783 BIOLOGICAL EFFECTS, ALGAE, CRUDE OIL, *[illegible]
0786 BIOLOGICAL EFFECTS, AROMATIC HYDROCARBONS, FISH, *MORONE SAXATILIS, *BENZENE,
0792 BIOLOGICAL EFFECTS, FUEL OIL, PLANTS, TROPICAL REGIONS, MALAYSIA, *PIONEER MANGROVE, *AVICENNIA INTERMEDIA,
0793 BIOLOGICAL EFFECTS, BERMUDA, TAR, INTERTIDAL ZONE, MARINE ORGANISMS, HYDROCARBONS,
0796 BIOLOGICAL EFFECTS, HYDROCARBONS, CONTAMINATION, MOLLUSKS, *SCALLOPS, *PECTEN YESSOENSIS,
0797 BIOLOGICAL EFFECTS, OIL SPILLS, CONTAMINATION, MARINE ORGANISMS, TROPICAL REGIONS, COASTS, PUERTO RICO, *MANGROVES, *TURTLE GRASS,
0800 BIOLOGICAL EFFECTS, OIL SPILLS, FUEL OIL, RESTORATION, STREAMS, INVERTEBRATES, FISH, NEW MEXICO,
0802 BIOLOGICAL EFFECTS, CONTAMINATION, SEDIMENTS, FUEL OIL, POLYCHAETES, METABOLISM, *FEEDING ACTIVITY, *ARENICOLA MARINA,
0805 BIOLOGICAL EFFECTS, HYDROCARBONS, FUEL OIL, POLYCHAETES, UPTAKE, METABOLISM, *NEANTHES ARENACEODENTATA,
0808 BIOLOGICAL EFFECTS, BEHAVIOR, CRUDE OIL, MOLLUSKS, SEDIMENTS, CHEMICAL ANALYSIS, *CLAM, *MACOMA BALTHICA,
0810 BIOLOGICAL EFFECTS, CONTAMINATION, HYDROCARBONS, METABOLISM, FISH,
0811 BIOLOGICAL EFFECTS, CRUDE OIL, INTERTIDAL ZONE, CRUSTACEANS, *BARNACLES, *CHTHAMALUS FISSUS,
0813 BIOLOGICAL EFFECTS, CRUDE OIL, MARINE ORGANISMS, INTERTIDAL ZONE,
0816 BIOLOGICAL EFFECTS, FUEL OIL, DISPERSANTS, MARINE ORGANISMS, INTERTIDAL ZONE, CHEMICAL ANALYSIS, *SPECIES DIVERSITY,
0817 BIOLOGICAL EFFECTS, CRUDE OIL, FISH, METABOLISM, ESTUARIES, *MULLET,
0831 BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, OIL SPILLS, CONTAMINATION, OCEANS, ESTUARIES, FATE, ENVIRONMENTAL EFFECTS, MARINE ORGANISMS,
0835 BIOLOGICAL EFFECTS, ATLANTIC OCEAN, OIL SPILLS, OFFSHORE DEVELOPMENT, MARINE ORGANISMS, OCS,
0836 BIOLOGICAL EFFECTS, PLATFORMS, OFFSHORE DRILLING, MARINE ORGANISMS, SANTA BARBARA CHANNEL,
0839 BIOLOGICAL EFFECTS, DEVELOPMENT, OIL SHALE, FISH, WILDLIFE, *US FISH & WILDLIFE SERVICE,
0880 BIOLOGICAL EFFECTS, BIODEGRADATION, ALASKA, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, OCS, HYDROCARBONS, MARINE ORGANISMS,
0904 BIOLOGICAL EFFECTS, ALASKA, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, OCS, CONTAMINANTS, MONITORING, INFORMATION SYSTEMS,
0952 BIOLOGICAL EFFECTS, API, FATE, OIL SPILLS, MARINE ORGANISMS,
0973 BIOLOGICAL EFFECTS, BENTHOS, BEACHES, OIL SPILLS, FATE, MOVEMENT, SEDIMENTS, PLANKTON, *CHEDABUCTO BAY,
0383 BIRDS, CONTAMINATION, COASTS, UK, *MORTALITY,
0513 BIRDS, OIL SPILLS, CLEANUP, POLLUTION PREVENTION, WILDLIFE, CHESAPEAKE BAY, USCG,
1625 BIRDS, RESTORATION, OIL SPILLS, CLEANUP, SOLVENTS, DELAWARE, *OLYMPIC GAMES SPILL,
0765 BIRDS, BIOLOGICAL EFFECTS, FUEL OIL, MONITORING, *REPRODUCTION,
0770 BIRDS, BIOLOGICAL EFFECTS, HYDROCARBONS, CHEMICAL ANALYSIS, METABOLISM, FOOD WEB, *EGGS,
0777 BIRDS, AFRICA/SOUTH, CONSERVATION, RESTORATION, *JACKASS PENGUIN,
0873 BIRDS, ALASKA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, *BASELINE STUDIES,
0874 BIRDS, ALASKA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, *BASELINE STUDIES,
0875 BIRDS, ALASKA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, *BASELINE STUDIES,
0806 BLM, MONITORING, OCS, COASTS, EIS, OIL/GAS LEASING, REGULATIONS, *ENVIRONMENTAL STUDIES PROJECT,
0885 BLM, ATLANTIC OCEAN, OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, OCS, MONITORING, GUIDELINES,
0883 BLM, ATLANTIC OCEAN, OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, PLATFORMS, OCS,
0901 BLM, OIL/GAS LEASING, EIS, ENVIRONMENTAL PROTECTION, OCS,
0761 BLOWOUT PREVENTION, DRILLING, DESIGN/ENGINEERING, PATENT,
0787 BLOWOUT PREVENTION, OIL SPILLS, OFFSHORE DRILLING, ICE, DISPERSANTS, CONTAINMENT, INCINERATION

0753 BLOWOUT PREVENTION, CONTAINMENT, OFFSHORE DRILLING, OIL SPILLS, NORTH SEA,
0897 BLOWOUT PREVENTION, ATLANTIC COAST, OFFSHORE DRILLING, OCS, TANKERS, OIL TRANSPORT, OIL SPILLS, CALIFORNIA COAST, MEXICO/GULF OF,
0900 BLOWOUT PREVENTION, BEAUFORT SEA, ARCTIC, POLLUTION CONTROL, OFFSHORE DRILLING,
0569 BOOMS, CONTAINMENT, OIL SPILLS, DESIGN-ENGINEERING, HIGH CURRENTS,
0570 BOOMS, CONTAINMENT, OIL SLICKS, DESIGN-ENGINEERING, PATENT,
0571 BOOMS, CONTAINMENT, OIL SPILLS, DESIGN-ENGINEERING, PATENT,
0573 BOOMS, CONTAINMENT, OIL SPILLS, DESIGN-ENGINEERING, EPA, *CONRETT
0574 BOOMS, BEAUFORT SEA, CONTAINMENT, OIL SLICKS, *ICE RIDGE KEEL,
0575 BOOMS, CONTAINMENT, OIL SPILLS, RIVERS, CONTINGENCY PLANNING, CANADA, US, *DETROIT-ST. CLAIR RIVER SYSTEM,
0598 BOOMS, OIL SPILLS, RECOVERY, SKIMMERS, OIL-WATER SEPARATION, DESIGN-ENGINEERING, *CONRETT,
0602 BOOMS, OIL SPILLS, RECOVERY, SKIMMERS, [illegible], FRANCE,
0603 BOOMS, OIL SPILLS, RECOVERY, SKIMMERS, CONTAINMENT, DESIGN-ENGINEERING, USCG,
0625 BOOMS, OIL SPILLS, RECOVERY, CONTAINMENT, SKIMMERS, EPA, *CONRETT,
0627 BOOMS, ABSORPTION, OIL SPILLS, CLEANUP, SKIMMERS, SURFACTANTS, DESIGN-ENGINEERING, USN,
0685 BOOMS, OIL SLICKS, DISPERSIONS, CONTAINMENT, MODELS, *DISPERSIVE OIL LOSSES,
0611 CALIFORNIA, OIL SPILLS, CLEANUP, POLLUTION CONTROL, *OAKLAND ESTUARY, *TELECOMMUNICATIONS SYSTEM,
0646 CALIFORNIA, ALASKA, OIL TRANSPORT, ENVIRONMENTAL EFFECTS, PIPELINES, ECONOMIC EFFECTS,
0853 CALIFORNIA COAST, OFFSHORE DRILLING, OIL INDUSTRY, ENVIRONMENTAL EFFECTS, ONSHORE IMPACTS,
0897 CALIFORNIA COAST, BLOWOUT PREVENTION, ATLANTIC COAST, OFFSHORE DRILLING, OCS, TANKERS, OIL TRANSPORT, OIL SPILLS, MEXICO/GULF OF,
0532 CALIFORNIA/SOUTHERN, TANKERS, OIL INDUSTRY, DEVELOPMENT, *SANSINENA EXPLOSION,
0487 CALIFORNIA/SOUTHERN, MONITORING, PAH, MOLLUSKS, CARCINOGENS, *MUSSELS, *BENZO(A)PYRENE,
0505 CALIFORNIA/SOUTHERN, MONITORING, HYDROCARBONS, SEDIMENTS, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION,
0859 CALIFORNIA/SOUTHERN, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, *GEOLOGIC HAZARDS,
0860 CALIFORNIA/SOUTHERN, ALASKA, OFFSHORE DRILLING, OFFSHORE DEVELOPMENT, ENVIRONMENTAL PROTECTION, REGULATIONS, MEXICO/GULF OF,
0454 CANADA, OIL SPILLS, *SALT WATER SPILLS, STATISTICS, PIPELINES, *ALBERTA,
0575 CANADA, BOOMS, CONTAINMENT, OIL SPILLS, RIVERS, CONTINGENCY PLANNING, US, *DETROIT-ST. CLAIR RIVER SYSTEM,
0601 CANADA, OIL SPILLS, CLEANUP, DISPERSANTS, *CANADIAN COAST GUARD,
0604 CANADA, RESTORATION, OIL SPILLS, CLEANUP, *NATION OIL SPILL,
0619 CANADA, ARCTIC, OIL SPILLS, RECOVERY, ICE, DESIGN-ENGINEERING, *CLEAN SWEEP,
0620 CANADA, OIL SPILLS, RECOVERY, CRUDE OIL, FUEL OIL, SKIMMERS, OIL-WATER SEPARATION,
0621 CANADA, OIL SPILLS, RECOVERY, SKIMMERS, EMULSIFICATION,
0675 CANADA, RESTORATION, SOIL, OIL SPILLS,
0712 CANADA, OIL SPILLS, PERSONNEL TRAINING, POLLUTION CONTROL, CLEANUP, CONTINGENCY PLANNING,
0715 CANADA, CONTINGENCY PLANNING, OIL SPILLS, POLLUTION CONTROL, CLEANUP, PERSONNEL TRAINING, OIL INDUSTRY,
0716 CANADA, CONTINGENCY PLANNING, US, OIL SPILLS, ST. LAWRENCE RIVER,
0719 CANADA, CONTINGENCY PLANNING, OIL SPILLS, *RESOURCE SENSITIVITY MAPS, *BRITISH COLUMBIA,
0721 CANADA, CONTINGENCY PLANNING, OIL SPILLS, CLEANUP, COASTS,
0725 CANADA, CONTINGENCY PLANNING, OIL SPILLS, INLAND, PERSONNEL TRAINING,
0763 CANADA, INVERTEBRATES, FISHERIES, TOXICITY, FISH, AQUATIC LIFE,
0776 CANADA, BIOLOGICAL EFFECTS, ARCTIC, CRUDE OIL, VEGETATION, OIL SPILLS,
0782 CANADA, BIOLOGICAL EFFECTS, OIL SPILLS, VEGETATION, MICROORGANISMS, SOIL,
0890 CANADA, BEAUFORT SEA, ARCTIC, OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS,
0891 CANADA, BEHAVIOR, ARCTIC, ICE, OIL SPILLS, MOVEMENT, OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, BLOWOUTS, *OIL-IN-ICE,
0952 CANADA, BEHAVIOR, OIL SPILLS, STATISTICAL ANALYSIS, WEATHERING, PIPELINES, INLAND,
0486 CARCINOGENS, MONITORING, PAH, COASTS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, SAMPLING, SPECTROMETRY, *COASTAL WATERS,
0487 CARCINOGENS, CALIFORNIA/SOUTHERN, MONITORING, PAH, MOLLUSKS, *MUSSELS, *BENZO(A)PYRENE,
0819 CARCINOGENS, PAH, MOLLUSKS, ESTUARIES, OREGON, ECONOMIC EFFECTS, *BENZO(A)PYRENE,
0923 CARCINOGENS, BIODEGRADATION, AROMATIC HYDROCARBONS, PAH, MICROORGANISMS,
0925 CARCINOGENS, BIODEGRADATION, BACTERIA, PAH, MICROORGANISMS,
0979 CARCINOGENS, PAH, FATE, DECOMPOSITION, ENVIRONMENTAL EFFECTS,
1002 CARCINOGENS, BIBLIOGRAPHIES, ANALYTICAL TECHNIQUES, FUEL OIL, PAH, PETROLEUM PRODUCTS,
1003 CARCINOGENS, BIBLIOGRAPHIES, ANALYTICAL TECHNIQUES, PAH, SOURCES, FATE, CHROMATOGRAPHY, SPECTROSCOPY, CRUDE OIL,
0820 CARIBBEAN SEA, OIL SPILLS, SOCIAL EFFECTS, ECONOMIC EFFECTS, FISHERIES, *GUATEMALA,
0950 CASPIAN SEA, BIODEGRADATION, BACTERIA, CRUDE OIL, PETROLEUM PRODUCTS, USSR,
0878 CHEDABUCTO BAY, BIOLOGICAL EFFECTS, BENTHOS, BEACHES, OIL SPILLS, FATE, MOVEMENT, SEDIMENTS, PLANKTON

[illegible] CHEDABUCTO BAY, FUEL OIL, SEDIMENTS, FATE, WEATHERING, HYDROCARBONS, METABOLISM, MOLLUSKS.
[illegible] CHEMICAL ANALYSIS, ALASKA/GULF OF, NATURAL SEEPAGE, HYDROCARBONS.
[illegible] CHEMICAL ANALYSIS, CARCINOGENS, MONITORING, PAH, COASTS, CHROMATOGRAPHY, SAMPLING, FLUORIMETRY, *COASTAL WATERS.
[illegible] CHEMICAL ANALYSIS, MONITORING, WASTEWATERS, DETECTION.
[illegible] CHEMICAL ANALYSIS, CALIFORNIA/SOUTHERN, MONITORING, HYDROCARBONS, SEDIMENTS, SOURCE IDENTIFICATION.
[illegible] CHEMICAL ANALYSIS, MONITORING, HYDROCARBONS, MARINE ORGANISMS, INTERTIDAL ZONE, CHROMATOGRAPHY, METABOLISM, *BIOGENIC HYDROCARBONS.
[illegible] CHEMICAL ANALYSIS, SAMPLING, HYDROCARBONS, PACIFIC OCEAN, *TANKER ROUTES.
[illegible] CHEMICAL ANALYSIS, SAMPLING, HYDROCARBONS, SEDIMENTS, SOURCES, DISTRIBUTION, MEXICO/GULF OF.
[illegible] CHEMICAL ANALYSIS, BENTHOS, SAMPLING, HYDROCARBONS, SEDIMENTS, UPTAKE, TAR, *ABYSSAL DEPTHS.
[illegible] CHEMICAL ANALYSIS, OIL SLICKS, CHROMATOGRAPHY, SPECTROSCOPY, DETECTION.
[illegible] CHEMICAL ANALYSIS, HYDROCARBONS, CHROMATOGRAPHY, SEAWATER.
[illegible] CHEMICAL ANALYSIS, OIL SPILLS, ESTUARIES, FISH, FATE, HYDROCARBONS, WEATHERING, *FUNDULUS HETEROCLITUS.
[illegible] CHEMICAL ANALYSIS, HYDROCARBONS, ZOOPLANKTON, SOURCES, DISTRIBUTION, MEXICO/GULF OF, *BIOGENIC HYDROCARBONS.
[illegible] CHEMICAL ANALYSIS, HYDROCARBONS, *PHENOLS, *SURFACE WATERS.
[illegible] CHEMICAL ANALYSIS, CHROMATOGRAPHY, CONTAMINANTS, WASTEWATERS, PETROLEUM PRODUCTS, PETROCHEMICALS, *GAS CHROMATOGRAPHY.
[illegible] CHEMICAL ANALYSIS, GASOLINE, CHROMATOGRAPHY, GROUNDWATER, CONTAMINATION.
[illegible] CHEMICAL ANALYSIS, AROMATIC HYDROCARBONS, SOLUBILITY.
[illegible] CHEMICAL ANALYSIS, HYDROCARBONS, MARINE ORGANISMS, CHROMATOGRAPHY, FISH.
[illegible] CHEMICAL ANALYSIS, HYDROCARBONS, OCEANS, SAMPLING.
[illegible] CHEMICAL ANALYSIS, HYDROCARBONS, MARINE ORGANISMS, CHROMATOGRAPHY, FISH, *SHRIMP, *SQUID, *N-PARAFFINS.
[illegible] CHEMICAL ANALYSIS, HYDROCARBONS, *INDUSTRIAL ORGANIC COMPOUNDS, *TENNESSEE RIVER.
[illegible] CHEMICAL ANALYSIS, CHROMATOGRAPHY, HYDROCARBONS, PETROLEUM PRODUCTS, PETROCHEMICALS, FUELS, WASTEWATERS.
[illegible] CHEMICAL ANALYSIS, CHROMATOGRAPHY, PAH, MARINE ORGANISMS, *SHELLFISH.
[illegible] CHEMICAL ANALYSIS, CHROMATOGRAPHY, CONTAMINANTS, HYDROCARBONS, WASTEWATERS, *LIQUID CHROMATOGRAPHY.
[illegible] CHEMICAL ANALYSIS, HYDROCARBONS, CHROMATOGRAPHY, SPECTROMETRY, SEDIMENTS, INTERTIDAL ZONE, *WATER ANALYSIS.
[illegible] CHEMICAL ANALYSIS, DETECTION, HYDROCARBONS, SEDIMENTS, CHROMATOGRAPHY, SOLVENTS, *N-PARAFFINS.
[illegible] CHEMICAL ANALYSIS, CHROMATOGRAPHY, HYDROCARBONS, CRUDE OIL, *SOILS, *ORGANIC SULFIDES.
[illegible] CHEMICAL ANALYSIS, PETROLEUM PRODUCTS, WASTEWATERS, MONITORING.
[illegible] CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, CONTAMINATION, CRUDE OIL, HYDROCARBONS, *WATER-SOLUBLE FRACTION.
[illegible] CHEMICAL ANALYSIS, BIODEGRADATION, DISPERSANTS, SEAWATER.
[illegible] CHEMICAL ANALYSIS, CHROMATOGRAPHY, PETROLEUM PRODUCTS, PAH, REFINERIES, WASTEWATERS, *LIQUID CHROMATOGRAPHY.
[illegible] CHEMICAL ANALYSIS, AROMATIC HYDROCARBONS, SOLUBILITY, *ALKYLBENZENES.
[illegible] CHEMICAL ANALYSIS, WASTEWATERS, CONTAMINANTS, *SOLVENT EXTRACTION, *IR SPECTROPHOTOMETRY.
[illegible] CHEMICAL ANALYSIS, CHROMATOGRAPHY, HYDROCARBONS, PAH, SOIL, *THIN-LAYER CHROMATOGRAPHY.
[illegible] CHEMICAL ANALYSIS, *INFRARED ANALYSIS, DETECTION, *OIL-IN-WATER.
[illegible] CHEMICAL ANALYSIS, CHROMATOGRAPHY, SOURCES, HYDROCARBONS, SEDIMENTS, DETECTION, LAKES, WASHINGTON.
[illegible] CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, HYDROCARBONS, WASTEWATERS, REFINERIES, *SEWAGE, *URBAN RUNOFF, REGULATIONS, DELAWARE.
[illegible] CHEMICAL ANALYSIS, HYDROCARBONS.
[illegible] CHEMICAL ANALYSIS, CHROMATOGRAPHY, SPECTROMETRY, CRUDE OIL, PETROLEUM PRODUCTS, HYDROCARBONS, EVAPORATION, *WATER SOLUBLE FRACTIONS.
[illegible] CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, PAH, OIL SPILLS, INCINERATION.
[illegible] CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, HYDROCARBONS, CHROMATOGRAPHY, SPECTROMETRY, DISTRIBUTION, SARGASSO SEA.
[illegible] CHEMICAL ANALYSIS, DISPERSANTS, OIL SPILLS, *DILUTION RATE.
[illegible] CHEMICAL ANALYSIS, BIRDS, BIOLOGICAL EFFECTS, HYDROCARBONS, METABOLISM, FOOD WEB, [illegible]
[illegible] CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, BEHAVIOR, CRUDE OIL, MOLLUSKS, SEDIMENTS, *CLAM, *MACOMA BALTHICA.
[illegible] CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, FUEL OIL, DISPERSIONS, MARINE ORGANISMS, INTERTIDAL ZONE, *SPECIES DIVERSITY.
[illegible] CHEMICAL ANALYSIS, ALASKA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, MICROORGANISMS, HYDROCARBONS, DISTRIBUTION, *BASELINE STUDIES.
[illegible] CHEMICAL ANALYSIS, BIODEGRADATION, CRUDE OIL, CHROMATOGRAPHY, OXIDATION, EVAPORATION, *PHOTOOXIDATION.
[illegible] CHESAPEAKE BAY, BIRDS, OIL SPILLS, CLEANUP, POLLUTION PREVENTION, WILDLIFE, USCG.
[illegible] CHESAPEAKE BAY, BEACHES, OIL SPILLS, ENVIRONMENTAL EFFECTS, MARSHES, MARINE ORGANISMS,

[illegible] CHESAPEAKE BAY, OIL SPILLS, DISPOSAL, INCINERATION, SALVAGE OIL.
[illegible] CHESAPEAKE BAY, BIOLOGICAL EFFECTS, OIL SPILLS, MARSHES, MARINE ORGANISMS, MOLLUSKS, *MARSH GRASS.
[illegible] CHESAPEAKE BAY, BIODEGRADATION, CRUDE OIL, MICROORGANISMS, ESTUARIES.
[illegible] CHESAPEAKE BAY, BIODEGRADATION, BACTERIA, OIL SPILLS, SEDIMENTS, *COLGATE CREEK.
[illegible] CHROMATOGRAPHY, CHEMICAL ANALYSIS, CARCINOGENS, MONITORING, PAH, COASTS, SAMPLING, *FLUORIMETRY, *COASTAL WATERS.
[illegible] CHROMATOGRAPHY, MONITORING, CRUDE OIL, DETECTION, SEDIMENTS, *OIL-IN-WATER, *BIOLOGICAL MATERIALS.
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[illegible] CHROMATOGRAPHY, CHEMICAL ANALYSIS, OIL SLICKS, SPECTROSCOPY, DETECTION.
[illegible] CHROMATOGRAPHY, CHEMICAL ANALYSIS, HYDROCARBONS, SEAWATER.
[illegible] CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, WASTEWATERS, REFINERIES, SPECTROMETRY.
[illegible] CHROMATOGRAPHY, CHEMICAL ANALYSIS, CONTAMINANTS, WASTEWATERS, PETROLEUM PRODUCTS, PETROCHEMICALS, *GAS CHROMATOGRAPHY.
[illegible] CHROMATOGRAPHY, CHEMICAL ANALYSIS, GASOLINE, GROUNDWATER, CONTAMINATION.
[illegible] CHROMATOGRAPHY, CHEMICAL ANALYSIS, HYDROCARBONS, MARINE ORGANISMS, FISH.
[illegible] CHROMATOGRAPHY, ALGAE, HYDROCARBONS, SEDIMENTS, MEXICO, GULF OF, MISSISSIPPI RIVER, SAMPLING.
[illegible] CHROMATOGRAPHY, CHEMICAL ANALYSIS, HYDROCARBONS, MARINE ORGANISMS, FISH, SHRIMP, *SQUID, *N-PARAFFINS.
[illegible] CHROMATOGRAPHY, CHEMICAL ANALYSIS, HYDROCARBONS, PETROLEUM PRODUCTS, PETROCHEMICALS, FUELS, WASTEWATERS.
[illegible] CHROMATOGRAPHY, CHEMICAL ANALYSIS, PAH, MARINE ORGANISMS, SHELLFISH.
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[illegible] CHROMATOGRAPHY, CHEMICAL ANALYSIS, SPECTROMETRY, CRUDE OIL, PETROLEUM PRODUCTS, HYDROCARBONS, EVAPORATION, *WATER SOLUBLE FRACTIONS.
[illegible] CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, SOURCE IDENTIFICATION, OIL SPILLS, SPECTROSCOPY, SAMPLING, USCG.
[illegible] CHROMATOGRAPHY, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, HYDROCARBONS, SPECTROMETRY, DISTRIBUTION, SARGASSO SEA.
[illegible] CHROMATOGRAPHY, CHEMICAL ANALYSIS, BIODEGRADATION, CRUDE OIL, OXIDATION, EVAPORATION, *PHOTOOXIDATION.
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[illegible] CHRONIC EFFECTS, ANALYTICAL TECHNIQUES, HYDROCARBONS, FATE, CONTAMINATION, MARINE ORGANISMS, COASTS.
[illegible] CHRONIC EFFECTS, ACUTE EFFECTS, MARINE ORGANISMS, CONTAMINATION, DESIGN-ENGINEERING, *CONTINUOUS FLOW BIOASSAY SYSTEM.
[illegible] CHRONIC EFFECTS, ANIMALS, HYDROCARBONS, CONTAMINATION, *IMMUNOLOGICAL RESPONSE.
[illegible] CHRONIC EFFECTS, OFFSHORE DRILLING, OFFSHORE PRODUCTION, CRUDE OIL, PLATFORMS, MARINE ORGANISMS.
[illegible] CHRONIC EFFECTS, MARINE ORGANISMS, HYDROCARBONS, CRUDE OIL, FISH, DESIGN-ENGINEERING, *FLOW-THROUGH SYSTEM.
[illegible] CHRONIC EFFECTS, CRUDE OIL, NATURAL SEEPAGE, MARINE ORGANISMS, MOLLUSKS, SANTA BARBARA CHANNEL.
[illegible] CHRONIC EFFECTS, ATLANTIC COAST, OFFSHORE PRODUCTION, ERDA, ENVIRONMENTAL EFFECTS, OIL DISCHARGES.
[illegible] CLEANUP, TANKERS, OIL TANKS, EXPLOSIONS, *SAFETY SYSTEMS.
[illegible] CLEANUP, ARGO MERCHANT SPILL, OIL SPILLS, TANKERS, *OLYMPIC GAMES SPILL, *[illegible] SPILL.
[illegible] CLEANUP, ALASKA, OIL SPILLS, TANKERS, ENVIRONMENTAL EFFECTS, *COLD BAY.
[illegible] CLEANUP, WEATHER, OIL SPILLS, CRUDE OIL, TANKERS, SPREADING, MOVEMENT, DISPERSANTS, JAPAN.
[illegible] CLEANUP, BIOLOGICAL EFFECTS, OIL SPILLS, POLLUTION PREVENTION, SURVEILLANCE, INTERNATIONAL AGREEMENTS.
[illegible] CLEANUP, ARCTIC, OIL SPILLS, RECOVERY, DISPOSAL, ECOSYSTEMS.
[illegible] CLEANUP, CHESAPEAKE BAY, BIRDS, OIL SPILLS, POLLUTION PREVENTION, WILDLIFE, USCG.
[illegible] CLEANUP, ARGO MERCHANT SPILL, OIL SPILLS, ENVIRONMENTAL EFFECTS, TANKERS.

1512 CLEANUP, SCOUT, SENSING, OIL SPILLS, POLLUTION CONTROL, LAW ENFORCEMENT, EPA,
0580 CLEANUP, ARGO MERCHANT SPILL, OIL SPILLS, SKIMMERS, USCG,
0581 CLEANUP, SKIMMERS, OIL SPILLS, MONITORING, MEDITERRANEAN SEA,
0583 CLEANUP, ALASKA, OIL SPILLS, ECONOMICS, TANKERS, PIPELINES, *OIL SPILL FUND,
0584 CLEANUP, ALASKA/GULF OF, OIL SPILLS, SKIMMERS, CONTAINMENT, DESIGN-ENGINEERING, COST ANALYSIS,
0585 CLEANUP, OIL SPILLS, RECOVERY, PATENT, DESIGN-ENGINEERING, *OLEOPHILIC SPONGE,
0586 CLEANUP, OIL SPILLS, SEAWATER, MOLLUSKS, OXIDATION, WATER PURIFICATION, *MUSSELS, *MYTILUS EDULIS,
0587 CLEANUP, BIODEGRADATION, OIL SPILLS, DISPERSANTS, TOXICITY,
0593 CLEANUP, BIODEGRADATION, DISPERSANTS, HYDROCARBONS, OIL SLICKS, PATENT, *NITROGEN COMPOUNDS,
0594 CLEANUP, BIODEGRADATION, DISPERSANTS, HYDROCARBONS, OIL SLICKS, PATENT, *NITROGEN COMPOUNDS,
0595 CLEANUP, BIODEGRADATION, DISPERSANTS, HYDROCARBONS, OIL SLICKS, PATENT, *NITROGEN COMPOUNDS,
0597 CLEANUP, API, DISPERSANTS, OIL SPILLS, ENVIRONMENTAL EFFECTS, CONTINGENCY PLANNING,
0599 CLEANUP, OIL SPILLS, POLLUTION CONTROL, ECONOMICS, [illegible],
0601 CLEANUP, CANADA, OIL SPILLS, DISPERSANTS, *CANADIAN COAST GUARD,
0602 CLEANUP, OIL SPILLS, MODELS, RECOVERY, COST ANALYSIS,
0604 CLEANUP, CANADA, RESTORATION, OIL SPILLS, [illegible] OIL SPILL,
0605 CLEANUP, BIODEGRADATION, BACTERIA, HYDROCARBONS, OIL SPILLS, PATENT,
0606 CLEANUP, DISPERSANTS, OIL SPILLS, TOXICITY, EPA,
0607 CLEANUP, ABSORPTION, OIL SLICKS, PETROLEUM PRODUCTS, DESIGN-ENGINEERING, PATENT,
0609 CLEANUP, OIL SPILLS, SKIMMERS, HARBORS, USN, *DEBRIS HANDLING SYSTEM,
0611 CLEANUP, CALIFORNIA, OIL SPILLS, POLLUTION CONTROL, *OAKLAND ESTUARY, *TELECOMMUNICATIONS SYSTEM,
0613 CLEANUP, ABSORPTION, WASTE OIL, PATENT,
0614 CLEANUP, TANKERS, OIL TANKS, SURFACTANTS,
0617 CLEANUP, OIL SPILLS, DISPERSANTS,
0619 CLEANUP, OIL SLICKS, DISPERSANTS, DESIGN-ENGINEERING, EPA, [illegible],
0625 CLEANUP, BIOLOGICAL EFFECTS, OIL SPILLS, MARSHES, MANUALS,
0627 CLEANUP, BOOMS, ABSORPTION, OIL SPILLS, SKIMMERS, SURFACTANTS, DESIGN-ENGINEERING, USN,
0635 CLEANUP, BIRDS, RESTORATION, OIL SPILLS, SOLVENTS, DELAWARE, *OLYMPIC GAMES SPILL,
0670 CLEANUP, ABSORPTION, OIL SPILLS, WASTE OIL, PATENT, *METALLURGICAL FUMES,
0710 CLEANUP, OIL SPILLS, PERSONNEL TRAINING, POLLUTION PREVENTION, CONTINGENCY PLANNING, TEXAS,
0712 CLEANUP, CANADA, OIL SPILLS, PERSONNEL TRAINING, POLLUTION CONTROL, CONTINGENCY PLANNING,
0714 CLEANUP, PERSONNEL TRAINING, OIL INDUSTRY, POLLUTION CONTROL, OIL SPILLS, RECOVERY, RESTORATION,
0716 CLEANUP, CANADA, CONTINGENCY PLANNING, OIL SPILLS, POLLUTION CONTROL, PERSONNEL TRAINING, OIL INDUSTRY,
0717 CLEANUP, CONTINGENCY PLANNING, OIL SPILLS, ENVIRONMENTAL EFFECTS, ST. LAWRENCE RIVER,
0718 CLEANUP, CONTINGENCY PLANNING, OIL SPILLS, PERSONNEL TRAINING, OIL FIELDS, NORTH SEA, *BP, FORTIES OILFIELD,
0721 CLEANUP, CONTINGENCY PLANNING, OIL SPILLS, GASOLINE, OIL INDUSTRY, *STANDARD OIL CO. INDIANA,
0722 CLEANUP, BEAUFORT SEA, CONTINGENCY PLANNING, OIL SPILLS, ICE,
0723 CLEANUP, CANADA, CONTINGENCY PLANNING, OIL SPILLS, *ARCTIC,
0726 CLEANUP, CONTINGENCY PLANNING, OIL SPILLS, POLLUTION CONTROL, ECONOMICS, *LOCAL GOVERNMENTS,
0738 CLEANUP, POLLUTION PREVENTION, OIL DISCHARGES, SHIPS, WASTE OIL TREATMENT, MONITORING, USN,
0742 CLEANUP, OIL SPILLS, POLLUTION CONTROL, DESIGN-ENGINEERING, USCG, *EQUIPMENT DELIVERY SYSTEM,
0745 CLEANUP, POLLUTION PREVENTION, OIL SPILLS, WASTE OIL DISPOSAL, [illegible] INDUSTRY,
0752 CLEANUP, POLLUTION CONTROL, OIL SPILLS, OCEANS, INLAND, ENVIRONMENTAL EFFECTS,
0772 CLEANUP, OIL SPILLS, ENVIRONMENTAL EFFECTS, CONTAMINATION, MARINE ORGANISMS, SEDIMENTS, CONTAINMENT, MAINE, *TAMANO SPILL,
0823 CLEANUP, CORALS, OIL SPILLS, FATE, MOVEMENT, COST ANALYSIS, STATISTICAL ANALYSIS,
0824 CLEANUP, OIL SPILLS, ENVIRONMENTAL EFFECTS, HYDROCARBONS, DISPERSANTS, EMULSIFIERS, PORTUGAL,
0826 CLEANUP, BIODEGRADATION, OIL SPILLS, ENVIRONMENTAL EFFECTS, SOURCES, RECOVERY, *BOOK REVIEW,
0908 CLEANUP, BIODEGRADATION, BACTERIA, OIL SLICKS, HYDROCARBONS, *NUTRIENT ENRICHMENT,
0910 CLEANUP, BIODEGRADATION, BACTERIA, OIL SLICKS, [illegible], GENETIC ENGINEERING,
0959 CLEANUP, OIL SPILLS, [illegible], DISPERSANTS, SPRAYING, [illegible],
1060 CLEANUP, LEGISLATION, POLLUTION CONTROL, LIABILITY, COST ANALYSIS, *FEDERAL WATER POLLUTION CONTROL ACT,
0576 COAGULATION, CONTAINMENT, OIL SPILLS, PATENT, POLYMERS,
0582 COAGULATION, WASTEWATER TREATMENT, OIL-WATER SEPARATION, EMULSIONS, PATENT,
0583 COALESCENCE, WASTEWATER TREATMENT, CONTAMINANTS, OIL-WATER SEPARATION, DESIGN-ENGINEERING, PATENT,
0584 COALESCENCE, DISPERSIONS, OIL-WATER SEPARATION, DESIGN-ENGINEERING, PATENT,

0565 COALESCENCE, EMULSIONS, OIL-WATER SEPARATION, PATENT.
0572 COALESCENCE, BALLAST, STORMWATER TREATMENT, OIL-WATER SEPARATION, PATENT.
0585 COALESCENCE, WASTEWATER TREATMENT, OIL-WATER SEPARATION, DESIGN-ENGINEERING, PATENT.
0589 COALESCENCE, WASTEWATER TREATMENT, OIL-WATER SEPARATION, FLOTATION, DESIGN-ENGINEERING, PATENT.
0555 COASTS, BIRDS, CONTAMINATION, US, MORTALITY.
0560 COASTS, OIL SPILLS, CONTAMINATION, SPAIN, SHELLFISH, URQUIOLA SPILL.
0477 COASTS, OIL SPILLS, US, STATISTICAL ANALYSIS, MODELS, GREAT LAKES, *DISCRIMINANT ANALYSIS.
0486 COASTS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, CARCINOGENS, MONITORING, PAH, SAMPLING, *FLUORIMETRY, *COASTAL WATERS.
0500 COASTS, BLM, NOAA, [illegible], OCS, EIA, OIL-GAS LEASING, REGULATIONS, *ENVIRONMENTAL STUDIES PROJECT.
0510 COASTS, REMOTE SENSING, CONTAMINANTS, OIL SLICKS, EUROPE, *NIMBUS SATELLITE.
0639 COASTS, PORTS, ENVIRONMENTAL EFFECTS, SOCIO-ECONOMIC EFFECTS, OIL SPILLS, *DEEPWATER PORTS.
0723 COASTS, CLEANUP, CANADA, CONTINGENCY PLANNING, OIL SPILLS.
0757 COASTS, CHRONIC EFFECTS, ANALYTICAL TECHNIQUES, HYDROCARBONS, FATE, CONTAMINATION, MARINE ORGANISMS.
0787 COASTS, BIOLOGICAL EFFECTS, OIL SPILLS, CONTAMINATION, MARINE ORGANISMS, *TROPICAL REGIONS, PUERTO RICO, *MANGROVES, *TURTLE GRASS.
0529 COASTS, CONTAMINATION, ENVIRONMENTAL EFFECTS, DEVELOPMENT, LEGISLATION, *ECOLOGY.
0561 COASTS, OFFSHORE DEVELOPMENT, OCS, EPA, ENVIRONMENTAL MANAGEMENT, OIL SPILLS, WATER QUALITY, ESTUARIES.
0594 COASTS, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, SOCIO-ECONOMIC EFFECTS, MEXICO/GULF OF.
0661 COASTS, OFFSHORE DRILLING, OIL SPILLS, FISHERIES, NEW YORK.
0668 COASTS, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, ONSHORE IMPACTS, SOCIO-ECONOMIC EFFECTS, REFINERIES, PORTS, FLORIDA, PIPELINES.
0915 COASTS, BIODEGRADATION, BACTERIA, HYDROCARBONS, OIL SLICKS, FRESHWATER.
0973 COASTS, MODELS, OIL SPILLS, MOVEMENT, OFFSHORE DRILLING, PORTS, NEW JERSEY, DELAWARE.
0565 COLORADO, OIL SHALE, DEVELOPMENT, EIS.
0985 COMPENSATION, ENVIRONMENTAL DETERIORATION, OIL SPILLS, WILDLIFE, MARINE ORGANISMS, ECONOMICS, *LEGAL ASPECTS.
0991 COMPENSATION, LEGISLATION, US, OIL SPILLS, LIABILITY, *SUPER-FUND.
0668 CONSERVATION, REFINERIES, WASTEWATER TREATMENT, DISPOSAL.
0673 CONSERVATION, WASTEWATER TREATMENT, REFINERIES, POLLUTION CONTROL, *WATER REUSE.
0777 CONSERVATION, BIRDS, AFRICA/SOUTH, RESTORATION, *JACKASS PENGUIN.
0569 CONTAINMENT, BOOMS, OIL SPILLS, DESIGN-ENGINEERING, *HIGH CURRENTS.
0570 CONTAINMENT, BOOMS, OIL SLICKS, DESIGN-ENGINEERING, PATENT.
0571 CONTAINMENT, BOOMS, OIL SPILLS, DESIGN-ENGINEERING, PATENT.
0572 CONTAINMENT, OIL SPILLS, RIVERS, DESIGN-ENGINEERING, *HYDROFOIL DEFLECTORS.
0573 CONTAINMENT, BOOMS, OIL SPILLS, DESIGN-ENGINEERING, EPA, *OHMSETT.
0575 CONTAINMENT, BOOMS, BEAUFORT SEA, OIL SLICKS, *ICE RIDGE KEEL.
0576 CONTAINMENT, CANADA, BOOMS, OIL SPILLS, RIVERS, CONTINGENCY PLANNING, US, *DETROIT-ST. CLAIR RIVER SYSTEM.
1675 CONTAINMENT, COAGULATION, OIL SPILLS, PATENT, *POLYMERS.
0584 CONTAINMENT, CLEANUP, ALASKA/GULF OF, OIL SPILLS, SKIMMERS, DESIGN-ENGINEERING, COST ANALYSIS.
0538 CONTAINMENT, BOOMS, OIL SPILLS, RECOVERY, SKIMMERS, DESIGN-ENGINEERING, USCG.
0612 CONTAINMENT, OIL SPILLS, RECOVERY, DESIGN-ENGINEERING, PATENT, *COLLECTION BARGE.
0615 CONTAINMENT, ARCTIC, OIL SPILLS, RECOVERY, REMOTE SENSING, STORAGE, DISPOSAL.
0622 CONTAINMENT, LEAKAGE, GASOLINE, OIL TANKS, RECOVERY, GROUNDWATER.
0624 CONTAINMENT, BOOMS, OIL SPILLS, RECOVERY, SKIMMERS, EPA, *OHMSETT.
0731 CONTAINMENT, OIL SPILLS, POLLUTION CONTROL, DETECTION, RECOVERY, DISPOSAL.
0761 CONTAINMENT, BLOWOUT PREVENTION, OIL SPILLS, OFFSHORE DRILLING, ICE, DISPERSANTS, INCINERATION.
0763 CONTAINMENT, BLOWOUT PREVENTION, OFFSHORE DRILLING, OIL SPILLS, NORTH SEA.
0772 CONTAINMENT, CLEANUP, OIL SPILLS, ENVIRONMENTAL EFFECTS, CONTAMINATION, MARINE ORGANISMS, SEDIMENTS, MAINE, *TAMANO SPILL.
0969 CONTAINMENT, BOOMS, OIL SLICKS, DISPERSIONS, BUBBLE, *DISPERSITE OIL LOSSES.
0490 CONTAMINANTS, ANALYTICAL TECHNIQUES, MONITORING, OCEANS, HYDROCARBONS, TAR, SAMPLING, MARINE ORGANISMS.
0510 CONTAMINANTS, COASTS, REMOTE SENSING, OIL SLICKS, EUROPE, *NIMBUS SATELLITE.
0538 CONTAMINANTS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, WASTEWATERS, PETROLEUM PRODUCTS, PETROCHEMICALS, *GAS CHROMATOGRAPHY.
0545 CONTAMINANTS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, HYDROCARBONS, WASTEWATERS, *LIQUID CHROMATOGRAPHY.
0547 CONTAMINANTS, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, OIL SHALE, EXTRACTION, *OIL-PRODUCT WATERS.
0557 CONTAMINANTS, CHEMICAL ANALYSIS, WASTEWATERS, SOLVENT EXTRACTION, *IR SPECTROPHOTOMETRY.
0626 CONTAMINANTS, ABSORPTION, PATENT, *POLYURETHANE FOAM.
0661 CONTAMINANTS, COALESCENCE, WASTEWATER TREATMENT, OIL-WATER SEPARATION, DESIGN-ENGINEERING, PATENT.

[illegible] CONTAMINANTS, WASTEWATER TREATMENT, FLOCCULATION, *FLOCCULANT-POLYELECTROLYTES,
[illegible] CONTAMINANTS, WASTEWATER TREATMENT, REFINERIES, *INTERMEDIATE TREATMENT
[illegible] CONTAMINANTS, ACTIVATED SLUDGE, WASTEWATER TREATMENT, REFINERIES, *BIOCHEMISTRY,
[illegible] CONTAMINANTS, WASTEWATER TREATMENT, HYDROCARBONS, *VACUUM STRIPPING,
[illegible] CONTAMINANTS, WASTEWATER TREATMENT, EXTRACTION, DESIGN-ENGINEERING, PATENT,
[illegible] CONTAMINANTS, OCEAN,
[illegible] CONTAMINANTS, OFFSHORE EXPLORATION, SPREADING, DISPERSIONS, PLATFORMS, OIL TRANSPORT,
[illegible] CONTAMINANTS, ATLANTIC COAST, OFFSHORE DRILLING, OCS, ENVIRONMENTAL PROTECTION,
MOVEMENT, *SOUTHEASTERN U.S., FDA,
[illegible] CONTAMINANTS, BIOLOGICAL EFFECTS, ALASKA, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS,
OCS, MONITORING, INFORMATION SYSTEMS,
[illegible] CONTAMINATION, COASTS, BIRDS, US, *MORTALITY,
[illegible] CONTAMINATION, COASTS, OIL SPILLS, SPAIN, *SHELLFISH, *URQUIOLA SPILL,
[illegible] CONTAMINATION, BILGES, BALLAST, MONITORING, SHIPS,
[illegible] CONTAMINATION, REMOTE SENSING, DETECTION, OIL SPILLS, HARBORS, *REMOTE LUMINESCENT
SENSOR,
[illegible] CONTAMINATION, SAMPLING, HYDROCARBONS, *EXTRACTABLE ORGANICS, HARBORS, NEW YORK,
DISTRIBUTION,
[illegible] CONTAMINATION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, GASOLINE, GROUNDWATER,
[illegible] CONTAMINATION, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, CRUDE OIL, HYDROCARBONS,
*WATER-SOLUBLE FRACTION,
[illegible] CONTAMINATION, RESTORATION, INLAND, SOIL, OIL FIELDS, *BRINES,
[illegible] CONTAMINATION, COASTS, CHRONIC EFFECTS, ANALYTICAL TECHNIQUES, HYDROCARBONS, FATE,
MARINE ORGANISMS,
[illegible] CONTAMINATION, BENTHOS, BEHAVIOR, FISH, *BUNKER OIL, *OIL-CONTAINING PREY, *FEEDING,
[illegible] CONTAMINATION, HYDROCARBONS, FISH, ESTUARIES, *MICROSOMAL MIXED FUNCTION OXIDASES,
*FUNDULUS HETEROCLITUS,
[illegible] CONTAMINATION, AROMATIC HYDROCARBONS, ACCUMULATION, WASTEWATERS, REFINERIES,
MOLLUSKS, FOOD WEB, *FOOD CHAIN, *3,4-BENZOPYRENE,
[illegible] CONTAMINATION, BIOLOGICAL EFFECTS, PUGET SOUND,
[illegible] CONTAMINATION, CONTAINMENT, CLEANUP, OIL SPILLS, ENVIRONMENTAL EFFECTS, MARINE
ORGANISMS, SEDIMENTS, MAINE, *TOBANO SPILL,
[illegible] CONTAMINATION, CHRONIC EFFECTS, ACUTE EFFECTS, MARINE ORGANISMS, DESIGN-ENGINEERING,
*CONTINUOUS FLOW BIOASSAY SYSTEM,
[illegible] CONTAMINATION, CHRONIC EFFECTS, ANIMALS, HYDROCARBONS, *IMMUNOLOGICAL RESPONSE,
[illegible] CONTAMINATION, BIOLOGICAL EFFECTS, HYDROCARBONS, MOLLUSKS, *SCALLOPS, *PECTEN
IRRADIANS,
[illegible] CONTAMINATION, COASTS, BIOLOGICAL EFFECTS, OIL SPILLS, MARINE ORGANISMS, TROPICAL
REGIONS, PUERTO RICO, *MANGROVES, *TURTLE GRASS,
[illegible] CONTAMINATION, BIOLOGICAL EFFECTS, SEDIMENTS, FUEL OIL, POLYCHAETES, METABOLISM,
*FEEDING ACTIVITY, *ARENICOLA MARINA,
[illegible] CONTAMINATION, BIOLOGICAL EFFECTS, HYDROCARBONS, METABOLISM, FISH,
[illegible] CONTAMINATION, ENVIRONMENTAL EFFECTS, PUGET SOUND,
[illegible] CONTAMINATION, COASTS, ENVIRONMENTAL EFFECTS, DEVELOPMENT, LEGISLATION, *ECOLOGY,
[illegible] CONTAMINATION, SHORELINES, JAPAN, DEVELOPMENT, ENVIRONMENTAL EFFECTS, MARINE
ORGANISMS,
[illegible] CONTAMINATION, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, OIL SPILLS, OCEANS, ESTUARIES,
FATE, ENVIRONMENTAL EFFECTS, MARINE ORGANISMS,
[illegible] CONTAMINATION, OIL INDUSTRY, ENVIRONMENTAL EFFECTS, POLLUTION CONTROL,
[illegible] CONTAMINATION, ENVIRONMENTAL EFFECTS, TOXICITY, OFFSHORE PRODUCTION, MARINE ORGANISMS,
*PRODUCED WATERS,
[illegible] CONTAMINATION, OIL SPILLS, INLAND, FATE, CRUDE OIL, MODELS, GROUNDWATER,
[illegible] CONTAMINATION, FATE, OIL SPILLS, INLAND, CRUDE OIL, GROUNDWATER, *PERSISTENCE,
[illegible] CONTAMINATION, GROUNDWATER, HYDROCARBONS, MOVEMENT, POLLUTION CONTROL,
[illegible] CONTAMINATION, API, FATE, TOXICITY, OIL SPILLS, MARINE ORGANISMS,
[illegible] CONTINGENCY PLANNING, OFFSHORE DEVELOPMENT, NORTH SEA, OIL SPILLS, LEAKAGE, *RATO,
[illegible] CONTINGENCY PLANNING, CONTAINMENT, CANADA, BOOMS, OIL SPILLS, RIVERS, US, *DETROIT-ST.
CLAIR RIVER SYSTEM,
[illegible] CONTINGENCY PLANNING, OIL SPILLS, RECOVERY, HYDROCARBONS, GROUNDWATER, COST ANALYSIS,
[illegible] CONTINGENCY PLANNING, CLEANUP, API, DISPERSANTS, OIL SPILLS, ENVIRONMENTAL EFFECTS,
[illegible] CONTINGENCY PLANNING, CLEANUP, OIL SPILLS, PERSONNEL TRAINING, POLLUTION PREVENTION,
TEXAS,
[illegible] CONTINGENCY PLANNING, OIL SPILLS, PERSONNEL TRAINING, POLLUTION CONTROL, USCG,
*SOLATSPORT EXERCISE,
[illegible] CONTINGENCY PLANNING, CLEANUP, CANADA, OIL SPILLS, PERSONNEL TRAINING, POLLUTION
CONTROL,
[illegible] CONTINGENCY PLANNING, CLEANUP, CANADA, OIL SPILLS, POLLUTION CONT'OL, PERSONNEL
TRAINING, OIL INDUSTRY,
[illegible] CONTINGENCY PLANNING, CANADA, US, OIL SPILLS, ST. LAWRENCE RIVER,
[illegible] CONTINGENCY PLANNING, CLEANUP, OIL SPILLS, ENVIRONMENTAL EFFECTS, ST. LAWRENCE RIVER,
[illegible] CONTINGENCY PLANNING, CLEANUP, OIL SPILLS, PERSONNEL TRAINING, OIL FIELDS, NORTH SEA,
*NORTHERN OILFIELD,
[illegible] CONTINGENCY PLANNING, CANADA, OIL SPILLS, *RESOURCE SENSITIVITY MAPS, *BRITISH
COLUMBIA,
[illegible] CONTINGENCY PLANNING, OIL SPILLS, FATE, ENVIRONMENTAL PROTECTION, SANTA BARBARA

CHANNEL, *CLEAN SEAS INC.

0721 CONTINGENCY PLANNING, CLEANUP, OIL SPILLS, GASOLINE, OIL INDUSTRY, *STANDARD OIL CO. INDIANA

0722 CONTINGENCY PLANNING, CLEANUP, BEAUFORT SEA, OIL SPILLS, ICE,

0723 CONTINGENCY PLANNING, COASTS, CLEANUP, CANADA, OIL SPILLS,

0724 CONTINGENCY PLANNING, CANADA, OIL SPILLS, INLAND, PERSONNEL TRAINING,

0725 CONTINGENCY PLANNING, CLEANUP, OIL SPILLS, POLLUTION CONTROL, ECONOMICS, *LOCAL GOVERNMENTS,

0730 CONTINGENCY PLANNING, POLLUTION PREVENTION, OIL SPILLS, STORAGE, PETROLEUM PRODUCTS, *OIL STORAGE PLAN,

0735 CONTINGENCY PLANNING, INTERNATIONAL CONVENTIONS, OIL SPILLS, SHIPS, OIL-WATER SEPARATION, POLLUTION PREVENTION, IMCO,

0744 CONTINGENCY PLANNING, OIL SPILLS, PERSONNEL TRAINING, POLLUTION CONTROL,

0830 CORALS, DRILLING, SEDIMENTS, *DRILL MUD, *CLEARING RATES

0767 CORAL REEFS, BIOLOGICAL EFFECTS, OIL SPILLS, TROPICAL REGIONS, MARINE ORGANISMS, INTERTIDAL ZONE, MANGROVE, FLORIDA COAST,

0584 COST ANALYSIS, CONTAINMENT, CLEANUP, ALASKA/GULF OF, OIL SPILLS, SKIMMERS, DESIGN-ENGINEERING

0581 COST ANALYSIS, CONTINGENCY PLANNING, OIL SPILLS, RECOVERY, HYDROCARBONS, GROUNDWATER

0603 COST ANALYSIS, CLEANUP, OIL SPILLS, MODELS, RECOVERY

0623 COST ANALYSIS, CLEANUP, MODELS, OIL SPILLS, FATE, MOVEMENT, STATISTICAL ANALYSIS,

0650 COST ANALYSIS, CLEANUP, LEGISLATION, POLLUTION CONTROL, LIABILITY, *FEDERAL WATER POLLUTION CONTROL ACT

0461 CRUDE OIL, CLEANUP, BEACHES, OIL SPILLS, TANKERS, SPREADING, MOVEMENT, DISPERSANTS, JAPAN,

0468 CRUDE OIL, STATISTICAL ANALYSIS, *OIL INPUT, SOURCES, OCEANS, WASTE OIL, OIL DISCHARGES, TANKERS, NATURAL SEEPAGE

0499 CRUDE OIL, CHROMATOGRAPHY, MONITORING, DETECTION, SEDIMENTS, *OIL-IN-WATER, *BIOLOGICAL MATERIALS,

0550 CRUDE OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS, HYDROCARBONS, *SOIL, *ORGANIC SULFIDES,

0552 CRUDE OIL, CONTAMINATION, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, HYDROCARBONS, *WATER-SOLUBLE FRACTION,

0563 CRUDE OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SPECTROMETRY, PETROLEUM PRODUCTS, HYDROCARBONS, EVAPORATION, *WATER SOLUBLE FRACTIONS,

0620 CRUDE OIL, CANADA, OIL SPILLS, RECOVERY, FUEL OIL, SKIMMERS, OIL-WATER SEPARATION,

0643 CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, U.S., LOUISIANA, *BAYOU CHOCTAW SALT DOME,

0644 CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, U.S., LOUISIANA, *COTE BLANCHE MINE,

0645 CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, U.S., LOUISIANA, *WEEKS ISLAND MINE,

0656 CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, OIL SPILLS, GROUNDWATER, VEGETATION, LOUISIANA, TEXAS, *SALT DOMES

0708 CRUDE OIL, WASTE OIL, RECLAMATION,

0750 CRUDE OIL, BENTHOS, ALGAE, TOXICITY, FUEL OIL, WASTE OIL, METABOLISM,

0751 CRUDE OIL, ALASKA, TOXICITY, CRUSTACEANS, *WATER SOLUBLE FRACTIONS, *LARVAL STAGES, *SHRIMP, *CRABS

0753 CRUDE OIL, TOXICITY, CRUSTACEANS, *WATER-SOLUBLE FRACTIONS, *CANCER MAGISTER DANA,

0760 CRUDE OIL, BIOLOGICAL EFFECTS, EMULSIONS, CRUSTACEANS, *SHRIMP, *FEEDING ACTIVITIES,

0773 CRUDE OIL, BIOLOGICAL EFFECTS, ALASKA, SEDIMENTS, MARINE ORGANISMS, ECOSYSTEMS,

0775 CRUDE OIL, METABOLISM, MOLLUSKS, *CLAMS, *MYA ARENARIA,

0776 CRUDE OIL, BIOLOGICAL EFFECTS, CRUSTACEANS, *LOBSTER, *HOMARUS AMERICANUS,

0778 CRUDE OIL, CANADA, BIOLOGICAL EFFECTS, ARCTIC, VEGETATION, OIL SPILLS,

0779 CRUDE OIL, BIOLOGICAL EFFECTS, MARINE MAMMALS, METABOLISM, *SEALS,

0780 CRUDE OIL, ALGAE, TOXICITY, VEGETATION, LAKES, SUBARCTIC REGIONS,

0785 CRUDE OIL, HYDROCARBONS, TOXICITY, PETROLEUM PRODUCTS, MARINE ORGANISMS, ECOSYSTEMS,

0787 CRUDE OIL, BIOLOGICAL EFFECTS, ALGAE, [illegible]

0794 CRUDE OIL, CHRONIC EFFECTS, OFFSHORE DRILLING, OFFSHORE PRODUCTION, PLATFORMS, MARINE ORGANISMS

0801 CRUDE OIL, ALASKA, FUEL OIL, TOXICITY, MARINE ORGANISMS, FISH, INVERTEBRATES, INTERTIDAL ZONE,

0804 CRUDE OIL, CHRONIC EFFECTS, MARINE ORGANISMS, HYDROCARBONS, FISH, DESIGN-ENGINEERING, *FLOW-THROUGH SYSTEM

0808 CRUDE OIL, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, BEHAVIOR, MOLLUSKS, SEDIMENTS, *CLAM, *MACOMA BALTHICA

0809 CRUDE OIL, ALGAE, *NAPHTHALENE, TOXICITY, FRESHWATER, METABOLISM, *CHLAMYDOMONAS ANGULOSA

0811 CRUDE OIL, CHRONIC EFFECTS, NATURAL SEEPAGE, MARINE ORGANISMS, MOLLUSKS, SANTA BARBARA CHANNEL

0812 CRUDE OIL, BIOLOGICAL EFFECTS, INTERTIDAL ZONE, CRUSTACEANS, *BARNACLES, *CHTHAMALUS FISSUS

0814 CRUDE OIL, BIOLOGICAL EFFECTS, MARINE ORGANISMS, INTERTIDAL ZONE,

0817 CRUDE OIL, BIOLOGICAL EFFECTS, FISH, METABOLISM, ESTUARIES, *MULLET,

0866 CRUDE OIL, BIODEGRADATION, ARCTIC, ALASKA, MICROORGANISMS,

0878 CRUDE OIL, BIODEGRADATION, OCEANS, MICROORGANISMS, NUTRIENT REQUIREMENTS,

0880 CRUDE OIL, BIODEGRADATION, ANALYTICAL TECHNIQUES, HYDROCARBONS, *PETROLEUM VARIETIES,

0890 CRUDE OIL, CASPIAN SEA, BIODEGRADABILITY, BACTERIA, PETROLEUM PRODUCTS, USSR,

0891 CRUDE OIL, BIODEGRADATION, PETROLEUM PRODUCTS, ENVIRONMENTAL EFFECTS, MICROORGANISMS, VEGETATION

[illegible] CRUDE OIL, BIODEGRADATION, MICROORGANISMS, HYDROCARBONS, PETROLEUM PRODUCTS,
GROUNDWATER, SOIL,
[illegible] CRUDE OIL, CHESAPEAKE BAY, BIODEGRADATION, MICROORGANISMS, ESTUARIES,
[illegible] CRUDE OIL, BIODEGRADATION, BACTERIA, MONITORING, SAMPLING, FATE,
[illegible] CRUDE OIL, ICE, SPREADING, OIL-ON-ICE,
[illegible] CRUDE OIL, BIODEGRADATION, OIL SPILLS, FATE, EVAPORATION, DISPERSIONS, OXIDATION, TAR,
[illegible] CRUDE OIL, CLEANUP, OIL SPILLS, DISPERSANTS, SPREADING, EMULSIFICATION, WEATHERING,
[illegible] CRUDE OIL, CONTAMINATION, OIL SPILLS, INLAND, FATE, MODELS, GROUNDWATER,
[illegible] CRUDE OIL, CONTAMINATION, FATE, OIL SPILLS, INLAND, GROUNDWATER, PERSISTENCE,
[illegible] CRUDE OIL, ARCTIC, OIL SPILLS, FATE, EVAPORATION, WEATHERING, SOLUTION,
EMULSIFICATION, TAR,
[illegible] CRUDE OIL, OIL SPILLS, WEATHERING, TAR, EVAPORATION, SOLUTION, SULFUR COMPOUNDS,
[illegible] CRUDE OIL, BEHAVIOR, HYDROCARBONS, SEDIMENTS, FATE, SOURCES, ENVIRONMENTAL EFFECTS,
[illegible] CRUDE OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS, BIODEGRADATION, OXIDATION, EVAPORATION,
PHOTOOXIDATION,
[illegible] CRUDE OIL, REGULATIONS, PETROLEUM PRODUCTS, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS,
FEA, MANDATORY OIL IMPORT PROGRAM,
[illegible] CRUDE OIL, CHROMATOGRAPHY, CARCINOGENS, BIBLIOGRAPHIES, ANALYTICAL TECHNIQUES, PAH,
SOURCES, FATE, SPECTROSCOPY,
[illegible] CRUSTACEANS, BIOLOGICAL EFFECTS, BEHAVIOR, FUEL OIL, KEROSENE, MOLLUSKS, SUBLETHAL
EFFECTS, LOBSTER, MUD SNAIL,
[illegible] CRUSTACEANS, CRUDE OIL, ALASKA, TOXICITY, WATER SOLUBLE FRACTIONS, LARVAL STAGES,
SHRIMP, CRABS,
[illegible] CRUSTACEANS, CRUDE OIL, TOXICITY, WATER-SOLUBLE FRACTIONS, CANCER MAGISTER DANA,
[illegible] CRUSTACEANS, CRUDE OIL, BIOLOGICAL EFFECTS, EMULSIONS, FEEDING, SENSING ACTIVITIES,
[illegible] CRUSTACEANS, CRUDE OIL, BIOLOGICAL EFFECTS, LOBSTER, HOMARUS AMERICANUS,
[illegible] CRUSTACEANS, CRUDE OIL, BIOLOGICAL EFFECTS, INTERTIDAL ZONE, BARNACLES, CHTHAMALUS
[illegible]
[illegible] DECOMPOSITION, BIODEGRADATION, OIL SPILLS, SOIL, MICROORGANISMS, MODELS, NUTRIENT
DEMAND,
[illegible] DECOMPOSITION, ADSORPTION, MODELS, OIL SPILLS, FATE, HYDROCARBONS, SPREADING,
SOLUTION, EMULSIFICATION,
[illegible] DECOMPOSITION, CARCINOGENS, TAR, FATE, ENVIRONMENTAL EFFECTS,
[illegible] DELAWARE, INDUSTRIES, REFINERIES, URBAN RUNOFF, OIL CONTENT, DELAWARE ESTUARY,
[illegible] DELAWARE, WASTEWATERS, REFINERIES, HYDROCARBONS, OIL CONTENT, URBAN RUNOFF,
DELAWARE ESTUARY,
[illegible] DELAWARE, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, HYDROCARBONS, WASTEWATERS,
REFINERIES, SEWAGE, URBAN RUNOFF, REGULATIONS,
[illegible] DELAWARE, CLEANUP, BIRDS, RESTORATION, OIL SPILLS, SOLVENTS, [illegible] SPILL,
[illegible] DELAWARE, TOXICITY, FUEL OIL, MARINE ORGANISMS, ESTUARIES, ULTRAVIOLET RADIATION,
[illegible] DELAWARE, OFFSHORE DEVELOPMENT, OIL INDUSTRY, OIL SPILLS, ENVIRONMENTAL DETERIORATION,
GOVERNMENT AGENCIES, [illegible]
[illegible] DELAWARE, ATLANTIC COAST, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ECONOMIC
EFFECTS,
[illegible] DELAWARE, COASTS, MODELS, OIL SPILLS, MOVEMENT, OFFSHORE DRILLING, PORTS, NEW JERSEY,
[illegible] DELAWARE, REGULATIONS, OFFSHORE DEVELOPMENT, ENVIRONMENTAL PROTECTION, ECONOMIC
EFFECTS,
[illegible] DELAWARE, LEGISLATION, US, OCS, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, POLLUTION
CONTROL, ECONOMICS,
[illegible] DELAWARE BAY, REMOTE SENSING, ESTUARIES, FRONTS, OIL SLICKS, DRIFT, SPREADING, MODELS,
[illegible] DELAWARE BAY, OIL SPILLS, FATE, MODELS, DRIFT, SPREADING,
[illegible] DELAWARE BAY, PORTS, OIL TRANSFER, LEGISLATION,
[illegible] DENMARK, OFFSHORE DEVELOPMENT, LIABILITY, EUROPE, UK, FRANCE, NORWAY, POLLUTION
DAMAGES,
[illegible] DESIGN-ENGINEERING, MONITORING, DETECTION, SHIPS, USCG, [illegible]
[illegible] DESIGN-ENGINEERING, [illegible], MONITORING, OIL DISCHARGES, SAMPLES,
[illegible] DESIGN-ENGINEERING, MONITORING, HYDROCARBONS, OIL-IN-WATER, FLUORESCENCE,
[illegible] DESIGN-ENGINEERING, MONITORING, LEAKAGE, DETECTION, OIL TANKS, PATENT,
[illegible] DESIGN-ENGINEERING, MONITORING, LEAKAGE, PIPELINES, OIL SLICKS, WASTEWATERS,
DETECTION, PATENT,
[illegible] DESIGN-ENGINEERING, MONITORING, HYDROCARBONS, DETECTION, PATENT,
[illegible] DESIGN-ENGINEERING, MONITORING, OIL SLICKS, ALARMS, [illegible]
[illegible] DESIGN-ENGINEERING, MONITORING, OIL DISCHARGES, WASTEWATERS, SHIPS, USCG, OIL CONTENT,
[illegible] DESIGN-ENGINEERING, REMOTE SENSING, OIL SPILLS, [illegible], SURVEILLANCE, LAW ENFORCEMENT,
ENVIRONMENTAL PROTECTION, USCG,
[illegible] DESIGN-ENGINEERING, CONTAINMENT, BOOMS, OIL SPILLS, RIVER CURRENTS,
[illegible] DESIGN-ENGINEERING, CONTAINMENT, BOOMS, OIL SLICKS, PATENT,
[illegible] DESIGN-ENGINEERING, CONTAINMENT, BOOMS, OIL SPILLS, PATENT,
[illegible] DESIGN-ENGINEERING, CONTAINMENT, OIL SPILLS, RIVERS, HYDROFOIL DEFLECTORS,
[illegible] DESIGN-ENGINEERING, CONTAINMENT, BOOMS, OIL SPILLS, EPA, [illegible]
[illegible] DESIGN-ENGINEERING, OIL SPILLS, SKIMMERS, RECOVERY, [illegible]
[illegible] DESIGN-ENGINEERING, OIL SPILLS, RECOVERY, [illegible]
[illegible] DESIGN-ENGINEERING, OIL SPILLS, RECOVERY, [illegible], ESTUARIES, [illegible]
[illegible] DESIGN-ENGINEERING, COST ANALYSIS, CONTAINMENT, CLEANUP, ALASKA GULF OF, OIL SPILLS,
SKIMMERS,

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0583  DESIGN-ENGINEERING, CLEANUP, OIL SPILLS, RECOVERY, PATENT, *OLEOPHILIC SPONGE,
0588  DESIGN-ENGINEERING, ABSORPTION, OIL SPILLS, RECOVERY,
0590  DESIGN-ENGINEERING, OIL SLICKS, RECOVERY, PATENT, *OLEOPHILIC CONTAINER,
0592  DESIGN-ENGINEERING, OIL SLICKS, RECOVERY, SKIMMERS, PATENT,
0594  DESIGN-ENGINEERING, SKIMMERS, OIL SLICKS, RECOVERY, PATENT,
0598  DESIGN-ENGINEERING, BOOMS, OIL SPILLS, RECOVERY, SKIMMERS, OIL-WATER SEPARATION,
        *COMMENT,
0600  DESIGN-ENGINEERING, OIL SPILLS, RECOVERY, SKIMMERS, USCG,
0607  DESIGN-ENGINEERING, CLEANUP, ABSORPTION, OIL SLICKS, PETROLEUM PRODUCTS, PATENT,
0608  DESIGN-ENGINEERING, CONTAINMENT, BOOMS, OIL SPILLS, RECOVERY, SKIMMERS, USCG,
0610  DESIGN-ENGINEERING, OIL SLICKS, SKIMMERS, RECOVERY, PATENT,
0612  DESIGN-ENGINEERING, CONTAINMENT, OIL SPILLS, RECOVERY, PATENT, *COLLECTION BARGE,
0615  DESIGN-ENGINEERING, CANADA, ARCTIC, OIL SPILLS, RECOVERY, ICE, *CLEAN SWEEP,
0618  DESIGN-ENGINEERING, ABSORPTION, OIL SPILLS, RECOVERY, RIVERS, ESTUARIES, HARBORS, EPA,
        *COMMENT,
0619  DESIGN-ENGINEERING, CLEANUP, OIL SLICKS, DISPERSANTS, EPA, *COMMENT,
0623  DESIGN-ENGINEERING, OIL SPILLS, RECOVERY, SKIMMERS, OIL-WATER SEPARATION,
0625  DESIGN-ENGINEERING, OIL SPILLS, RECOVERY, SKIMMERS, PATENT,
0627  DESIGN-ENGINEERING, CLEANUP, BOOMS, ABSORPTION, OIL SPILLS, SKIMMERS, SURFACTANTS, USN,
0629  DESIGN-ENGINEERING, SKIMMERS, OIL SLICKS, RECOVERY, PATENT,
0634  DESIGN-ENGINEERING, DEVELOPMENT, PORTS, ENVIRONMENTAL PROTECTION, REGULATIONS,
0658  DESIGN-ENGINEERING, OIL-WATER SEPARATION, PATENT,
0659  DESIGN-ENGINEERING, OIL-WATER SEPARATION, PATENT,
0661  DESIGN-ENGINEERING, CONTAMINANTS, COALESCENCE, WASTEWATER TREATMENT, OIL-WATER
        SEPARATION, PATENT,
0664  DESIGN-ENGINEERING, COALESCENCE, DISPERSIONS, OIL-WATER SEPARATION, PATENT,
0535  DESIGN-ENGINEERING, OIL-WATER SEPARATION, EMULSIONS, FLOCCULATION, PRECIPITATION,
0686  DESIGN-ENGINEERING, COALESCENCE, WASTEWATER TREATMENT, OIL-WATER SEPARATION, PATENT,
0689  DESIGN-ENGINEERING, COALESCENCE, WASTEWATER TREATMENT, OIL-WATER SEPARATION,
        FLOTATION, PATENT,
0693  DESIGN-ENGINEERING, OIL-WATER SEPARATION, WASTEWATER TREATMENT, PATENT,
0697  DESIGN-ENGINEERING, CONTAMINANTS, WASTEWATER TREATMENT, EXTRACTION, PATENT,
0698  DESIGN-ENGINEERING, OIL WELLS, OIL-WATER SEPARATION, PATENT,
0701  DESIGN-ENGINEERING, BILGES, OIL-WATER SEPARATION, SHIPS, USN,
0727  DESIGN-ENGINEERING, OIL TANKS, LEAKAGE, SOIL POLLUTION PREVENTION, STORAGE, PATENT,
0735  DESIGN-ENGINEERING, OIL TANKS, LEAKAGE, DETECTION, PATENT,
0742  DESIGN-ENGINEERING, CLEANUP, OIL SPILLS, POLLUTION CONTROL, USCG, *EQUIPMENT DELIVERY
        SYSTEM,
0743  DESIGN-ENGINEERING, BLOWOUT PREVENTION, DRILLING, PATENT,
0756  DESIGN-ENGINEERING, LEAKAGE, OIL TANKS, DETECTION, PATENT,
0783  DESIGN-ENGINEERING, CONTAMINATION, CHRONIC EFFECTS, ACUTE EFFECTS, MARINE ORGANISMS,
        *CONTINUOUS FLOW BIOASSAY SYSTEM,
0806  DESIGN-ENGINEERING, CRUDE OIL, CHRONIC EFFECTS, MARINE ORGANISMS, HYDROCARBONS, FISH,
        *FLOW-THROUGH SYSTEM,
0482  DETECTION, DESIGN-ENGINEERING, MONITORING, SHIPS, USCG, *OIL-IN-WATER,
0486  DETECTION, ANALYTICAL TECHNIQUES, MONITORING, WASTEWATERS, *LIGHT SCATTERING,
        *PARTICULATES, *OIL-IN-WATER,
0492  DETECTION, CHEMICAL ANALYSIS, MONITORING, WASTEWATERS,
0495  DETECTION, DESIGN-ENGINEERING, MONITORING, LEAKAGE, OIL TANKS, PATENT,
0499  DETECTION, CRUDE OIL, CHROMATOGRAPHY, MONITORING, SEDIMENTS, *OIL-IN-WATER,
        *BIOLOGICAL MATERIALS,
0532  DETECTION, DESIGN-ENGINEERING, MONITORING, LEAKAGE, PIPELINES, OIL SLICKS,
        WASTEWATERS, PATENT,
0501  DETECTION, DESIGN-ENGINEERING, MONITORING, HYDROCARBONS, PATENT,
0511  DETECTION, REMOTE SENSING, OIL SLICKS, SURVEILLANCE, NATURAL SEEPAGE, SANTA BARBARA
        CHANNEL,
0512  DETECTION, REMOTE SENSING, OIL SLICKS, SOURCE IDENTIFICATION, MICROWAVE RADIOMETRY,
0514  DETECTION, REMOTE SENSING, OIL SLICKS, NATURAL SEEPAGE, PLATFORMS, SANTA BARBARA
        CHANNEL, USCG, *SIDE-LOOKING RADAR,
0516  DETECTION, REMOTE SENSING, OIL SPILLS, SURVEILLANCE, USCG, *AIRBORNE COASTAL PATROL,
0517  DETECTION, CONTAMINATION, REMOTE SENSING, OIL SPILLS, HARBORS, *REMOTE LUMINESCENT
        SENSOR,
0521  DETECTION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, OIL SLICKS, SPECTROSCOPY,
0524  DETECTION, ANALYTICAL TECHNIQUES, ABSORPTION, OIL SLICKS, PETROLEUM PRODUCTS,
0543  DETECTION, ANALYTICAL TECHNIQUES, HYDROCARBONS,
0546  DETECTION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, HYDROCARBONS, SEDIMENTS, SOLVENTS,
        *N-PARAFFINS,
0552  DETECTION, CHEMICAL ANALYSIS, INFRARED ANALYSIS, *OIL-IN-WATER,
0560  DETECTION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SOURCES, HYDROCARBONS, SEDIMENTS, LAKES,
        WASHINGTON,
0591  DETECTION, LEAKAGE, PIPELINES, SMALL COMPUTERS,
0736  DETECTION, DESIGN-ENGINEERING, OIL TANKS, LEAKAGE, PATENT,
0733  DETECTION, CONTAINMENT, OIL SPILLS, POLLUTION CONTROL, RECOVERY, DISPOSAL ,
0748  DETECTION, LEAKAGE, PETROLEUM PRODUCTS, PATENT,
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[illegible] DETECTION, DESIGN-ENGINEERING, LEAKAGE, OIL TANKS, PATENT,
[illegible] DEVELOPMENT, CALIFORNIA/SOUTHERN, TANKERS, OIL INDUSTRY, [illegible] EXPLOSION,
[illegible] DEVELOPMENT, DESIGN-ENGINEERING, PORTS, ENVIRONMENTAL PROTECTION, REGULATIONS,
[illegible] DEVELOPMENT, CONTAMINATION, COASTS, ENVIRONMENTAL EFFECTS, LEGISLATION, *ECOLOGY,
[illegible] DEVELOPMENT, CONTAMINATION, SHORELINES, JAPAN, ENVIRONMENTAL EFFECTS, MARINE ORGANISMS,
0839 DEVELOPMENT, BIOLOGICAL EFFECTS, OIL SHALE, FISH, WILDLIFE, FWS FISH & WILDLIFE SERVICE,
[illegible] DEVELOPMENT, COLORADO, OIL SHALE, EIS,
[illegible] DEVELOPMENT, OIL SHALE, EIS, *ROCKY MOUNTAIN STATES,
[illegible] DEVELOPMENT, OIL SHALE, ENVIRONMENTAL EFFECTS, *EXTRACTION,
[illegible] DEVELOPMENT, OIL SHALE, ENVIRONMENTAL EFFECTS, *LIQUID WASTES, SOLID WASTES, LEACHING,
[illegible] DEVELOPMENT, PIPELINES, STORAGE, OIL INDUSTRY, SCOTLAND, *SULLOM VOE TERMINAL,
[illegible] DEVELOPMENT, PLATFORMS, EIS, ENVIRONMENTAL EFFECTS, SCOTLAND,
[illegible] DISPERSANTS, CRUDE OIL, CLEANUP, BEACHES, OIL SPILLS, TANKERS, SPREADING, MOVEMENT, JAPAN,
[illegible] DISPERSANTS, CHEMICAL ANALYSIS, BIODEGRADATION, SEAWATER,
[illegible] DISPERSANTS, CLEANUP, BIODEGRADATION, OIL SPILLS, TOXICITY,
[illegible] DISPERSANTS, CHEMICAL ANALYSIS, OIL SPILLS, *DILUTION RATE,
[illegible] DISPERSANTS, CLEANUP, BIODEGRADATION, HYDROCARBONS, OIL SLICKS, PATENT, *NITROGEN COMPOUNDS,
0994 DISPERSANTS, CLEANUP, BIODEGRADATION, HYDROCARBONS, OIL SLICKS, PATENT, *NITROGEN COMPOUNDS,
0995 DISPERSANTS, CLEANUP, BIODEGRADATION, HYDROCARBONS, OIL SLICKS, PATENT, *NITROGEN COMPOUNDS,
[illegible] DISPERSANTS, CONTINGENCY PLANNING, CLEANUP, API, OIL SPILLS, ENVIRONMENTAL EFFECTS,
0601 DISPERSANTS, CLEANUP, CANADA, OIL SPILLS, *CANADIAN COAST GUARD,
[illegible] DISPERSANTS, CLEANUP, OIL SPILLS, TOXICITY, EPA,
0617 DISPERSANTS, CLEANUP, OIL SPILLS,
0619 DISPERSANTS, DESIGN-ENGINEERING, CLEANUP, OIL SLICKS, EPA, *SUMMARY,
0751 DISPERSANTS, CONTAINMENT, BLOWOUT PREVENTION, OIL SPILLS, OFFSHORE DRILLING, ICE, INCINERATION,
[illegible] DISPERSANTS, CLEANUP, OIL SPILLS, ENVIRONMENTAL EFFECTS, HYDROCARBONS, SHORELINES, PORTUGAL,
[illegible] DISPERSANTS, CRUDE OIL, CLEANUP, OIL SPILLS, SPREADING, EMULSIFICATION, WEATHERING,
[illegible] DISPERSIONS, DESIGN-ENGINEERING, COALESCENCE, OIL-WATER SEPARATION, PATENT,
[illegible] DISPERSIONS, CONTAMINANTS, OFFSHORE EXPLORATION, SPREADING, PLATFORMS, OIL TRANSPORT,
[illegible] DISPERSIONS, CRUDE OIL, BIODEGRADATION, OIL SPILLS, FATE, EVAPORATION, OXIDATION, TAR,
[illegible] DISPERSIONS, CONTAINMENT, BOOMS, OIL SLICKS, MODELS, *DISPERSIVE OIL LOSSES,
0470 DISPOSAL, CLEANUP, ARCTIC, OIL SPILLS, RECOVERY, [illegible],
0615 DISPOSAL, CONTAINMENT, ARCTIC, OIL SPILLS, RECOVERY, REMOTE SENSING, STORAGE,
[illegible] DISPOSAL, ECONOMICS, OIL INDUSTRY, WASTEWATERS, WASTE OIL, SOLID WASTES, RECYCLING,
[illegible] DISPOSAL, CONSERVATION, REFINERIES, WASTEWATER TREATMENT,
[illegible] DISPOSAL, BIODEGRADATION, OIL SPILLS, HYDROCARBONS, MANUALS, *DEBRIS,
[illegible] DISPOSAL, WASTE OIL, PETROCHEMICALS, STORAGE, MANUALS, USN,
[illegible] DISPOSAL, CHESAPEAKE BAY, OIL SPILLS, INCINERATION, *BLACK OIL,
[illegible] DISPOSAL, BIOLOGICAL EFFECTS, WASTE OIL, RECYCLING, REUSE,
[illegible] DISPOSAL, DETECTION, CONTAINMENT, OIL SPILLS, POLLUTION CONTROL, RECOVERY,
[illegible] DISTRIBUTION, HYDROCARBONS, SOURCES, INDUSTRIES, REFINERIES, *MUNICIPAL DISCHARGES, RUNOFF,
[illegible] DISTRIBUTION, ATLANTIC OCEAN, MONITORING, TAR, SAMPLING,
[illegible] DISTRIBUTION, BEAUFORT SEA, MONITORING, HYDROCARBONS, WATER QUALITY,
[illegible] DISTRIBUTION, MONITORING, HYDROCARBONS, OCEANS, SURVEILLANCE,
[illegible] DISTRIBUTION, SAMPLING, HYDROCARBONS, PACIFIC OCEAN, *TANKER ROUTES,
[illegible] DISTRIBUTION, CHEMICAL ANALYSIS, SAMPLING, HYDROCARBONS, SEDIMENTS, SOURCES, MEXICO/GULF OF,
0524 DISTRIBUTION, BACTERIA, SAMPLING, HYDROCARBONS, MICROORGANISMS, TAR, SEDIMENTS, OFFSHORE DEVELOPMENT, NORTH SEA,
0525 DISTRIBUTION, CONTAMINATION, SAMPLING, HYDROCARBONS, *EXTRACTABLE ORGANICS, HARBORS, NEW YORK,
0532 DISTRIBUTION, CHEMICAL ANALYSIS, HYDROCARBONS, ZOOPLANKTON, SOURCES, MEXICO/GULF OF, *BIOGENIC HYDROCARBONS,
0568 DISTRIBUTION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, HYDROCARBONS, SPECTROMETRY, SARGASSO SEA,
0651 DISTRIBUTION, HYDROCARBONS, OIL TRANSFER, OCEANS, MARINE ORGANISMS, FOOD WEB, *TRANSFER PROCESSES,
0771 DISTRIBUTION, BEHAVIOR, FISH, *NAPHTHALENES, UPTAKE, RELEASE, *STRESS, *FUNDULUS SIMILUS,
[illegible] DISTRIBUTION, BACTERIA, OIL SPILLS, ESTUARIES, MICROORGANISMS,
0881 DISTRIBUTION, CHEMICAL ANALYSIS, ALASKA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, MICROORGANISMS, HYDROCARBONS, BASELINE STUDIES,
0882 DISTRIBUTION, BIODEGRADATION, ALASKA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, HYDROCARBONS, BASELINE STUDIES,
[illegible] DISTRIBUTION, HYDROCARBONS, SEDIMENTS, LAKES,

0976 DISTRIBUTION, GUIDELINES, WASTEWATER TREATMENT, PRODUCTION, STORAGE, OIL-WATER SEPARATION, POLLUTION CONTROL
0515 DRIFT, DELAWARE BAY, REMOTE SENSING, ESTUARIES, CURRENTS, OIL SLICKS, SPREADING, MODELS,
0947 DRIFT, ALASKA/GULF OF, MODELS, OIL SPILLS, MOVEMENT, OCS,
0967 DRIFT, BEAUFORT SEA, MODELS, OIL SPILLS, SHORELINES, OCS, *STORM MODELING,
0966 DRIFT, MODELS, OIL SPILLS, BARRIERS, SPREADING, [illegible],
0946 DRIFT, DELAWARE BAY, OIL SPILLS, FATE, MODELS, SPREADING,
0971 DRILLING, OIL INDUSTRY, EXPLORATION, MICHIGAN, *BAKER SANCTUARY,
0956 DRILLING, ANALYTICAL TECHNIQUES, WATER QUALITY, *DRILLING MUDS,
0734 DRILLING, DESIGN-ENGINEERING, BLOWOUT PREVENTION, PATENT,
0938 DRILLING, CORALS, SEDIMENTS, *DRILL MUD, *CLEARING RATES,
0995 DRILLING, GUIDELINES, PRODUCTION, EXPLORATION, WASTEWATERS, EPA, *ONSHORE POINT SOURCE CATEGORY,
0846 ECONOMIC EFFECTS, CALIFORNIA, ALASKA, OIL TRANSPORT, ENVIRONMENTAL EFFECTS, PIPELINES,
0734 ECONOMIC EFFECTS, POLLUTION CONTROL, OIL SPILLS, *COSTS, MODELS, *POLLUTER RESPONSE,
0816 ECONOMIC EFFECTS, OIL SPILLS, TOXICITY, POLLUTION CONTROL, *SHELL OIL CO,
0616 ECONOMIC EFFECTS, CARCINOGENS, FISH, MOLLUSKS, ESTUARIES, OREGON, *BENZO(A)PYRENE,
0820 ECONOMIC EFFECTS, CARIBBEAN SEA, OIL SPILLS, SOCIAL EFFECTS, FISHERIES, *GUATEMALA,
0825 ECONOMIC EFFECTS, OIL SPILLS, TANKERS, FATE, ENVIRONMENTAL EFFECTS, MODELS, WILDLIFE, *WORLD WAR II SPILLS,
0851 ECONOMIC EFFECTS, OFFSHORE DEVELOPMENT, ONSHORE IMPACTS, SCOTLAND,
0854 ECONOMIC EFFECTS, OFFSHORE EXPLORATION, OIL-GAS LEASING, FLORIDA, ONSHORE IMPACTS,
0856 ECONOMIC EFFECTS, DELAWARE, ATLANTIC COAST, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS,
0926 ECONOMIC EFFECTS, ATLANTIC COAST, OIL SPILLS, OFFSHORE DEVELOPMENT, FISHERIES,
0984 ECONOMIC EFFECTS, DELAWARE, REGULATIONS, OFFSHORE DEVELOPMENT, ENVIRONMENTAL PROTECTION,
0987 ECONOMIC EFFECTS, CRUDE OIL, REGULATIONS, PETROLEUM PRODUCTS, ENVIRONMENTAL EFFECTS, FEA, *MANDATORY OIL IMPORT PROGRAM,
0988 ECONOMIC EFFECTS, LEGISLATION, US, POLLUTION CONTROL, REFINERIES, OIL INDUSTRY,
0458 ECONOMICS, ALASKA, PIPELINES, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, *TRANS-ALASKA PIPELINE,
0583 ECONOMICS, CLEANUP, ALASKA, OIL SPILLS, TANKERS, PIPELINES, *OIL SPILL FUND,
0599 ECONOMICS, CLEANUP, OIL SPILLS, POLLUTION CONTROL, TEXAS, *CORPUS CHRISTI,
0650 ECONOMICS, TANKERS, OIL TRANSPORT, OIL SPILLS, POLLUTION CONTROL, REGULATIONS, *STANDARDS,
0642 ECONOMICS, DISPOSAL, OIL INDUSTRY, WASTEWATERS, WASTE OIL, SOLID WASTES, RECYCLING,
0685 ECONOMICS, WASTEWATER TREATMENT, PETROCHEMICALS, LEGISLATION, GERMANY, WEST,
0705 ECONOMICS, CONTINGENCY PLANNING, CLEANUP, OIL SPILLS, POLLUTION CONTROL, *LOCAL GOVERNMENTS,
0842 ECONOMICS, REGULATIONS, POLLUTION CONTROL, OIL INDUSTRY, REFINING, EXPLORATION, PRODUCTION,
0852 ECONOMICS, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS,
0870 ECONOMICS, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, OFFSHORE DRILLING,
0702 ECONOMICS, OIL-GAS LEASING, OCS, OFFSHORE DEVELOPMENT, ENVIRONMENTAL PROTECTION, *SUBSI,
0985 ECONOMICS, DELAWARE, LEGISLATION, US, OCS, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, POLLUTION CONTROL,
0989 ECONOMICS, COMPENSATION, ENVIRONMENTAL DETERIORATION, OIL SPILLS, WILDLIFE, MARINE ORGANISMS, *LEGAL ASPECTS,
0997 ECONOMICS, GUIDELINES, WASTEWATER TREATMENT, OIL INDUSTRY, REFINERIES, LEGISLATION, WATER QUALITY,
0570 ECOSYSTEMS, DISPOSAL, CLEANUP, ARCTIC, OIL SPILLS, RECOVERY,
0773 ECOSYSTEMS, CRUDE OIL, BIOLOGICAL EFFECTS, ALASKA, SEDIMENTS, MARINE ORGANISMS,
0784 ECOSYSTEMS, CRUDE OIL, HYDROCARBONS, TOXICITY, PETROLEUM PRODUCTS, MARINE ORGANISMS,
0911 ECOSYSTEMS, BIODEGRADATION, HYDROCARBONS, MICROORGANISMS, FRESHWATER,
0500 EIS, COASTAL, BLM, MONITORING, OCS, OIL-GAS LEASING, REGULATIONS, *ENVIRONMENTAL STUDIES PROJECT,
0843 EIS, CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, LOUISIANA, *BAYOU CHOCTAW SALT DOMES,
0844 EIS, CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, LOUISIANA, *COTE BLANCHE MINE,
0845 EIS, CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, LOUISIANA, *WEEKS ISLAND MINE,
0849 EIS, DEVELOPMENT, COLORADO, OIL SHALE,
0880 EIS, ATLANTIC OCEAN, OCS, *GEOLOGIC FRAMEWORK,
0893 EIS, DEVELOPMENT, PLATFORMS, ENVIRONMENTAL EFFECTS, SCOTLAND,
0903 EIS, BLM, OIL-GAS LEASING, ENVIRONMENTAL PROTECTION, OCS,
0906 EIS, OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, SANTA BARBARA CHANNEL, *AIR QUALITY IMPACTS,
0521 EMULSIFICATION, CANADA, OIL SPILLS, RECOVERY, SKIMMERS,
0829 EMULSIFICATION, DISPERSANTS, CRUDE OIL, CLEANUP, OIL SPILLS, SPREADING, WEATHERING,
0840 EMULSIFICATION, DECOMPOSITION, ABSORPTION, MODELS, OIL SPILLS, FATE, HYDROCARBONS, SPREADING, SOLUTION,
0874 EMULSIFICATION, CRUDE OIL, ARCTIC, OIL SPILLS, FATE, EVAPORATION, WEATHERING, SOLUTION, TAR,
0680 EMULSIONS, COALESCENCE, OIL-WATER SEPARATION, PATENT,
0686 EMULSIONS, DESTABILIZATION, OIL-WATER SEPARATION, FLOCCULATION, PRECIPITATION,
0687 EMULSIONS, OIL-WATER SEPARATION, WASTEWATERS, REFINERIES, FLOCCULATION,

[illegible] EMULSIONS, COAGULATION, WASTEWATER TREATMENT, OIL WATER SEPARATION, PATENT,
[illegible] EMULSIONS, WASTEWATER TREATMENT, WASTE OIL, PATENT,
[illegible] [illegible]
[illegible] ENVIRONMENTAL [illegible], OFFSHORE DEVELOPMENT, OIL TERMINALS, OIL SPILLS,
GOVERNMENT AGENCIES, COASTAL [illegible]
0868 ENVIRONMENTAL DEGRADATION, ATLANTIC OCEAN, OFFSHORE DEVELOPMENT, OCS, HYDROCARBONS,
HEALTH HAZARDS
0960 ENVIRONMENTAL DEGRADATION, ECONOMICS, COMPENSATION, OIL SPILLS, WILDLIFE, MARINE
ORGANISMS, LEGAL ASPECTS
[illegible] ENVIRONMENTAL EFFECTS, OIL SPILLS, MEXICO/GULF OF, OCS, [illegible]
[illegible] ENVIRONMENTAL EFFECTS, ATLANTIC COAST, ARGO MERCHANT SPILL, OIL SPILLS, TANKERS,
[illegible] ENVIRONMENTAL EFFECTS, ECONOMICS, ALASKA, PIPELINES, OFFSHORE DEVELOPMENT, OCS,
TRANS ALASKA PIPELINE
[illegible] ENVIRONMENTAL EFFECTS, CLEANUP, ALASKA, OIL SPILLS, TANKERS, [illegible] BAY
[illegible] ENVIRONMENTAL EFFECTS, OIL SPILLS, WASTE OIL, RIVERS, VEGETATION, PENNSYLVANIA,
SCHUYLKILL SPILL
0873 ENVIRONMENTAL EFFECTS, ALASKA, OIL SPILLS, OFFSHORE DRILLING, KACHEMAK BAY
[illegible] ENVIRONMENTAL EFFECTS, CHESAPEAKE BAY, BEACHES, OIL SPILLS, [illegible], MARINE ORGANISMS,
[illegible] ENVIRONMENTAL EFFECTS, CLEANUP, ARGO MERCHANT SPILL, OIL SPILLS, TANKERS
[illegible] ENVIRONMENTAL EFFECTS, DISPERSANTS, CONTINGENCY PLANNING, CLEANUP, API, OIL SPILLS,
[illegible] ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, PORTS, TANKERS, SOCIO-ECONOMIC EFFECTS,
DEEPWATER TERMINALS
0639 ENVIRONMENTAL EFFECTS, COASTS, PORTS, SOCIO-ECONOMIC EFFECTS, OIL SPILLS, DEEPWATER
PORTS
0642 ENVIRONMENTAL EFFECTS, PORTS, OIL TRANSFER, FLORIDA, MEXICO/GULF OF, SOCIO-ECONOMIC
EFFECTS, LEGISLATION, DEEPWATER PORTS
[illegible] ENVIRONMENTAL EFFECTS, SPR, CRUDE OIL, STORAGE, LOUISIANA, BAYOU CHOCTAW SALT DOMES,
[illegible] ENVIRONMENTAL EFFECTS, SPR, CRUDE OIL, STORAGE, LOUISIANA, COTE BLANCHE MINE
[illegible] ENVIRONMENTAL EFFECTS, SPR, CRUDE OIL, STORAGE, LOUISIANA, WEEKS ISLAND MINE
[illegible] ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, CALIFORNIA, ALASKA, OIL TRANSPORT, PIPELINES,
[illegible] ENVIRONMENTAL EFFECTS, ANIMALS, OIL TRANSPORT, PIPELINES, ESTUARIES, PLANTS,
MONITORING, FLORIDA
0659 ENVIRONMENTAL EFFECTS, PORTS, OIL TRANSPORT, STORAGE, SOCIAL EFFECTS, OIL SPILLS,
PACIFIC OCEAN, PALAU, SUPERPORT
[illegible] ENVIRONMENTAL EFFECTS, CRUDE OIL, STORAGE, OIL SPILLS, GROUNDWATER, VEGETATION,
LOUISIANA, TEXAS, SALT DOMES
0717 ENVIRONMENTAL EFFECTS, CONTINGENCY PLANNING, CLEANUP, OIL SPILLS, ST. LAWRENCE RIVER,
[illegible] ENVIRONMENTAL EFFECTS, POLLUTION PREVENTION, OCEANS, STORAGE, OIL SPILLS,
[illegible] ENVIRONMENTAL EFFECTS, CLEANUP, POLLUTION CONTROL, OIL SPILLS, OCEANS, ISLAND
0772 ENVIRONMENTAL EFFECTS, CONTAMINATION, CONTAINMENT, CLEANUP, OIL SPILLS, MARINE
ORGANISMS, SEDIMENTS, MAINE, [illegible] SPILL
0824 ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, OIL SPILLS, TANKERS, FATE, MODELS, WILDLIFE,
WORLD WAR II SPILLS
0825 ENVIRONMENTAL EFFECTS, DISPERSANTS, CLEANUP, OIL SPILLS, HYDROCARBONS, SHORELINES,
PORTUGAL
0826 ENVIRONMENTAL EFFECTS, CLEANUP, BIODEGRADATION, OIL SPILLS, SOURCES, RECOVERY, BOOK
REVIEW
0827 ENVIRONMENTAL EFFECTS, CONTAMINATION, PUGET SOUND
0829 ENVIRONMENTAL EFFECTS, DEVELOPMENT, CONTAMINATION, COASTS, LEGISLATION, ECOLOGY,
0830 ENVIRONMENTAL EFFECTS, DEVELOPMENT, CONTAMINATION, SHORELINES, JAPAN, MARINE
ORGANISMS
0832 ENVIRONMENTAL EFFECTS, CONTAMINATION, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, OIL SPILLS,
OCEANS, ESTUARIES, FATE, MARINE ORGANISMS
0835 ENVIRONMENTAL EFFECTS, POLLUTION CONTROL, REGULATIONS, LEGISLATION, US
0837 ENVIRONMENTAL EFFECTS, OIL SPILLS, OFFSHORE DRILLING, FISHERIES, MARINE ORGANISMS,
GEORGES BANK
0845 ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, FISHERIES, US, REGULATIONS, OIL INDUSTRY,
0850 ENVIRONMENTAL EFFECTS, OIL SHALE, PRODUCTION, EXTRACTION, SOLID WASTES, WASTEWATERS,
0852 ENVIRONMENTAL EFFECTS, ECONOMICS, OFFSHORE DEVELOPMENT
0853 ENVIRONMENTAL EFFECTS, CALIFORNIA COAST, OFFSHORE DRILLING, OIL INDUSTRY, ONSHORE
IMPACTS
0854 ENVIRONMENTAL EFFECTS, COASTS, OFFSHORE DEVELOPMENT, OCS, SOCIO-ECONOMIC EFFECTS,
MEXICO/GULF OF
0856 ENVIRONMENTAL EFFECTS, CHRONIC EFFECTS, ATLANTIC COAST, OFFSHORE PRODUCTION, ERDA, OIL
DISCHARGES
0857 ENVIRONMENTAL EFFECTS, DEVELOPMENT, OIL SHALE, EXTRACTION
0858 ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, DELAWARE, ATLANTIC COAST, OFFSHORE
DEVELOPMENT, OCS
0859 ENVIRONMENTAL EFFECTS, CALIFORNIA/SOUTHERN, OFFSHORE DEVELOPMENT, OCS, GEOLOGIC
HAZARDS
0861 ENVIRONMENTAL EFFECTS, CONTAMINATION, OIL INDUSTRY, POLLUTION CONTROL
0863 ENVIRONMENTAL EFFECTS, CONTAMINATION, TOXICITY, OFFSHORE PRODUCTION, MARINE ORGANISMS,
PRODUCED WATERS
0865 ENVIRONMENTAL EFFECTS, BLM, ATLANTIC OCEAN, OFFSHORE DRILLING, OCS, MONITORING,
GUIDELINES

0861 ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS,
0867 ENVIRONMENTAL EFFECTS, OFFSHORE DRILLING, OIL SPILLS,
0869 ENVIRONMENTAL EFFECTS, [illegible] OCEAN, OFFSHORE DRILLING, PLATFORMS, OCS,
0870 ENVIRONMENTAL EFFECTS, ECONOMICS, OFFSHORE DEVELOPMENT, OFFSHORE DRILLING, OCS
0871 ENVIRONMENTAL EFFECTS, OFFSHORE PRODUCTION, OIL INDUSTRY, HYDROCARBONS, MARINE ORGANISMS, SEDIMENTS, LOUISIANA
0872 ENVIRONMENTAL EFFECTS, DEVELOPMENT, OIL SHALE, *LIQUID WASTES, SOLID WASTES, LEACHING
0873 ENVIRONMENTAL EFFECTS, ALASKA, OFFSHORE DEVELOPMENT, OCS, MARINE MAMMALS, *BASELINE STUDIES
0874 ENVIRONMENTAL EFFECTS, BIRDS, ALASKA, OFFSHORE DEVELOPMENT, OCS, *BASELINE STUDIES,
0875 ENVIRONMENTAL EFFECTS, BIRDS, ALASKA, OFFSHORE DEVELOPMENT, OCS, *BASELINE STUDIES,
0876 ENVIRONMENTAL EFFECTS, BIRDS, ALASKA, OFFSHORE DEVELOPMENT, OCS, *BASELINE STUDIES,
0877 ENVIRONMENTAL EFFECTS, BERING SEA, BENTHOS, BEAUFORT SEA, ALASKA, OFFSHORE DEVELOPMENT, OCS, MARINE ORGANISMS, *BASELINE STUDIES
0878 ENVIRONMENTAL EFFECTS, ALASKA, OFFSHORE DEVELOPMENT, OCS, FISH, MOLLUSKS, HABITAT, *BASELINE STUDIES
0879 ENVIRONMENTAL EFFECTS, BENTHOS, ALASKA, OFFSHORE DEVELOPMENT, OCS, PLANKTON, FISHERIES, *BASELINE STUDIES
0880 ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, BIODEGRADATION, ALASKA, OFFSHORE DEVELOPMENT, OCS, HYDROCARBONS, MARINE ORGANISMS
0881 ENVIRONMENTAL EFFECTS, DISTRIBUTION, CHEMICAL ANALYSIS, ALASKA, OFFSHORE DEVELOPMENT, OCS, MICROORGANISMS, HYDROCARBONS, *BASELINE STUDIES
0882 ENVIRONMENTAL EFFECTS, DISTRIBUTION, BIODEGRADATION, ALASKA, OFFSHORE DEVELOPMENT, OCS, HYDROCARBONS, *BASELINE STUDIES
0883 ENVIRONMENTAL EFFECTS, ALASKA, OFFSHORE DEVELOPMENT, OCS, [illegible]ELINE STUDIES, *PHYSICAL OCEANOGRAPHY, METEOROLOGY
0884 ENVIRONMENTAL EFFECTS, ALASKA, OFFSHORE DEVELOPMENT, OCS, *BASELINE STUDIES, *GEOLOGIC HAZARDS, *MARINE GEOLOGY
0885 ENVIRONMENTAL EFFECTS, ALASKA, OFFSHORE DEVELOPMENT, OCS, *BASELINE STUDIES, *GEOLOGIC HAZARDS
0886 ENVIRONMENTAL EFFECTS, ARCTIC OCEAN, ALASKA, OFFSHORE DEVELOPMENT, OCS, ICE, *BASELINE STUDIES
0888 ENVIRONMENTAL EFFECTS, COASTS, OFFSHORE DEVELOPMENT, ONSHORE IMPACTS, SOCIO-ECONOMIC EFFECTS, REFINERIES, PORTS, FLORIDA, PIPELINES,
0890 ENVIRONMENTAL EFFECTS, CANADA, BEAUFORT SEA, ARCTIC, OFFSHORE DRILLING,
0891 ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, PUGET SOUND, MEXICO/GULF OF, FATE, HYDROCARBONS, TOXICITY, MARINE ORGANISMS, NOAA
0893 ENVIRONMENTAL EFFECTS, ATLANTIC OCEAN, OIL SPILLS, OCS, OIL-GAS LEASING, FATE, *RISK ANALYSIS
0895 ENVIRONMENTAL EFFECTS, EIS, DEVELOPMENT, PLATFORMS, SCOTLAND,
0897 ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, OIL SPILLS, PIPELINES, FLORIDA,
0898 ENVIRONMENTAL EFFECTS, ATLANTIC OCEAN, OFFSHORE DEVELOPMENT, OCS,
0899 ENVIRONMENTAL EFFECTS, ATLANTIC OCEAN, OFFSHORE DEVELOPMENT, SOCIO-ECONOMIC EFFECTS,
0901 ENVIRONMENTAL EFFECTS, ARCTIC, EXPLORATION, PRODUCTION, PLANTS, WILDLIFE, OIL SPILLS, MARINE ORGANISMS
0904 ENVIRONMENTAL EFFECTS, CONTAMINANTS, BIOLOGICAL EFFECTS, ALASKA, OFFSHORE DEVELOPMENT, OCS, MONITORING, INFORMATION SYSTEMS,
0906 ENVIRONMENTAL EFFECTS, EIS, OFFSHORE DRILLING, SANTA BARBARA CHANNEL, *AIR QUALITY IMPACTS
0919 ENVIRONMENTAL EFFECTS, BIODEGRADATION, OIL SPILLS, SOIL, FATE,
0941 ENVIRONMENTAL EFFECTS, CRUDE OIL, BIODEGRADATION, PETROLEUM PRODUCTS, MICROORGANISMS, OXIDATION,
0951 ENVIRONMENTAL EFFECTS, CANADA, BEHAVIOR, ARCTIC, ICE, OIL SPILLS, MOVEMENT, OFFSHORE DRILLING, *BLOWOUTS, *OIL-IN-ICE,
0965 ENVIRONMENTAL EFFECTS, BEACHES, METULA SPILL, FATE, TANKERS, ESTUARIES, MARINE ORGANISMS, MAGELLAN/STRAIT OF,
0976 ENVIRONMENTAL EFFECTS, CRUDE OIL, BEHAVIOR, HYDROCARBONS, SEDIMENTS, FATE, SOURCES,
0978 ENVIRONMENTAL EFFECTS, DECOMPOSITION, CARCINOGENS, FAA, FATE,
0986 ENVIRONMENTAL EFFECTS, ECONOMICS, DELAWARE, LEGISLATION, US, OCS, OFFSHORE DEVELOPMENT, POLLUTION CONTROL,
0987 ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, CRUDE OIL, REGULATIONS, PETROLEUM PRODUCTS, FEA, MANDATORY OIL IMPORT PROGRAM
0991 ENVIRONMENTAL MANAGEMENT, COASTS, OFFSHORE DEVELOPMENT, OCS, EPA, OIL SPILLS, WATER QUALITY, ESTUARIES,
0108 ENVIRONMENTAL PROTECTION, DESIGN-ENGINEERING, REMOTE SENSING, OIL SPILLS, SHIPS, SURVEILLANCE, LAW ENFORCEMENT, USCG,
0647 ENVIRONMENTAL PROTECTION, OIL SPILLS, TANKERS, METULA SPILL, OFFSHORE DRILLING, POLLUTION CONTROL,
0655 ENVIRONMENTAL PROTECTION, DEVELOPMENT, DESIGN-ENGINEERING, PORTS, REGULATIONS,
0700 ENVIRONMENTAL PROTECTION, CONTINGENCY PLANNING, OIL SPILLS, FATE, SANTA BARBARA CHANNEL, CLEAN SEAS INC,
0713 ENVIRONMENTAL PROTECTION, OIL SPILLS, POLLUTION PREVENTION, GUIDELINES, HARBORS,
0715 ENVIRONMENTAL PROTECTION, SHIPS, TANKERS, INLAND, OFFSHORE PRODUCTION, MONITORING,
0717 ENVIRONMENTAL PROTECTION, OIL SPILLS, TANKERS, COLOMBIA, IMCO,

0846 ENVIRONMENTAL PROTECTION, CONTAMINANTS, ATLANTIC COAST, OFFSHORE DRILLING, OCS, MOVEMENT, *SOUTHEASTERN U.S., ERDA

0850 ENVIRONMENTAL PROTECTION, CALIFORNIA/SOUTHERN, ALASKA, OFFSHORE DRILLING, OFFSHORE DEVELOPMENT, REGULATIONS, MEXICO/GULF OF

085C ENVIRONMENTAL PROTECTION, ECONOMICS, OIL-GAS LEASING, OCS, OFFSHORE DEVELOPMENT, *USGS,

0853 ENVIRONMENTAL PROTECTION, EIS, BLM, OIL-GAS LEASING, OCS

0864 ENVIRONMENTAL PROTECTION, ECONOMIC EFFECTS, DELAWARE, REGULATIONS, OFFSHORE DEVELOPMENT

0801 EPA, MONITORING, HYDROCARBONS, OIL SPILLS, POLLUTION CONTROL, SURVEILLANCE, GOVERNMENT AGENCIES, USGS, USCG, *UN

0816 EPA, CLEANUP, REMOTE SENSING, OIL SPILLS, POLLUTION CONTROL, LAW ENFORCEMENT,

0813 EPA, DESIGN-ENGINEERING, CONTAINMENT, BOOMS, OIL SPILLS, *OHMSETT,

0806 EPA, DISPERSANTS, CLEANUP, OIL SPILLS, TOXICITY

0818 EPA, DESIGN-ENGINEERING, ABSORPTION, OIL SPILLS, RECOVERY, RIVERS, ESTUARIES, HARBORS, *OHMSETT

0819 EPA, DISPERSANTS, DESIGN-ENGINEERING, CLEANUP, OIL SLICKS, *OHMSETT,

0844 EPA, CONTAINMENT, BOOMS, OIL SPILLS, RECOVERY, SKIMMERS, *OHMSETT,

0251 EPA, POLLUTION CONTROL, OIL INDUSTRY, REFINERIES

0851 EPA, ENVIRONMENTAL MANAGEMENT, COASTS, OFFSHORE DEVELOPMENT, OCS, OIL SPILLS, WATER QUALITY, ESTUARIES

0855 EPA, DEVELOPMENT, OIL SHALE, *ROCKY MOUNTAIN STATES,

0884 EPA, DRILLING, GUIDELINES, PRODUCTION, EXPLORATION, WASTEWATERS, *ONSHORE POINT SOURCE CATEGORY

0885 EPA, GUIDELINES, PRODUCTION, EXTRACTION, OIL INDUSTRY, WASTEWATERS, *ONSHORE POINT SOURCE CATEGORY

0846 ERDA, ENVIRONMENTAL PROTECTION, CONTAMINANTS, ATLANTIC COAST, OFFSHORE DRILLING, OCS, MOVEMENT, *SOUTHEASTERN U.S.,

0856 ERDA, ENVIRONMENTAL EFFECTS, CHRONIC EFFECTS, ATLANTIC COAST, OFFSHORE PRODUCTION, OIL DISCHARGES

0815 ESTUARIES, DRIFT, DELAWARE BAY, REMOTE SENSING, *PLUMES, OIL SLICKS, SPREADING, MODELS,

0543 ESTUARIES, BENTHOS, ALASKA, SAMPLING, WATER QUALITY, *EPIFAUNA,

0530 ESTUARIES, CHEMICAL ANALYSIS, OIL SPILLS, FISH, FATE, HYDROCARBONS, WEATHERING, *FUNDULUS HETEROCLITUS

0819 ESTUARIES, DESIGN-ENGINEERING, OIL SPILLS, RECOVERY, HARBORS, *CLEAN SWEEP,

0818 ESTUARIES, EPA, DESIGN-ENGINEERING, ABSORPTION, OIL SPILLS, RECOVERY, RIVERS, HARBORS, *OHMSETT

0649 ESTUARIES, ENVIRONMENTAL EFFECTS, ANIMALS, OIL TRANSPORT, PIPELINES, PLANTS, MONITORING, FLORIDA,

0795 ESTUARIES, OIL SPILLS, POLLUTION CONTROL, MARSHES, MOVEMENT, *GRASS-CUTTING, *HACKENSACK ESTUARY

0756 ESTUARIES, BIOLOGICAL EFFECTS, BENTHOS, ATLANTIC COAST, OIL SPILLS, WEATHERING, PLANKTON, FISH

0762 ESTUARIES, CONTAMINATION, HYDROCARBONS, FISH, *MICROSOMAL MIXED FUNCTION OXIDASES, *FUNDULUS HETEROCLITUS

0746 ESTUARIES, DISTRIBUTION, BACTERIA, OIL SPILLS, MICROORGANISMS,

0807 ESTUARIES, DELAWARE, TOXICITY, FUEL OIL, MARINE ORGANISMS, *ULTRA-VIOLET RADIATION,

0817 ESTUARIES, CRUDE OIL, BIOLOGICAL EFFECTS, FISH, METABOLISM, *MULLET

0819 ESTUARIES, ECONOMIC EFFECTS, CARCINOGENS, TAR, MOLLUSKS, OREGON, *BENZO(A)PYRENE,

0812 ESTUARIES, ENVIRONMENTAL EFFECTS, CONTAMINATION, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, OIL SPILLS, OCEANS, FATE, MARINE ORGANISMS

0851 ESTUARIES, EPA, ENVIRONMENTAL MANAGEMENT, COASTS, OFFSHORE DEVELOPMENT, OCS, OIL SPILLS, WATER QUALITY

0535 ESTUARIES, CRUDE OIL, CHESAPEAKE BAY, BIODEGRADATION, MICROORGANISMS,

0565 ESTUARIES, ENVIRONMENTAL EFFECTS, BEACHES, METULA SPILL, FATE, TANKERS, MARINE ORGANISMS, MAGELLAN/STRAIT OF

0872 ESTUARIES, BIODEGRADATION, ATLANTIC COAST, ADSORPTION, HYDROCARBONS, FATE, RIVERS, TAR,

0810 EUROPE, CONTAMINANTS, COASTS, REMOTE SENSING, OIL SLICKS, *NIMBUS SATELLITE,

0726 EUROPE, POLLUTION CONTROL, LEGISLATION, OIL DISCHARGES, *MARINE POLLUTION,

0858 EUROPE, DAMAGES, OFFSHORE DEVELOPMENT, LIABILITY, UK, FRANCE, NORWAY, *POLLUTION DAMAGE

0321 EUROPE, OIL INDUSTRY, REGULATIONS, PIPELINES, WASTEWATERS, GUIDELINES,

0881 EVAPORATION, CRUDE OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SPECTROMETRY, PETROLEUM PRODUCTS, HYDROCARBONS, *WATER SOLUBLE FRACTIONS,

0850 EVAPORATION, OIL SPILLS, HYDROCARBONS, SOLUTION,

0855 EVAPORATION, MODELS, OIL SPILLS, WEATHERING

0857 EVAPORATION, DISPERSIONS, CRUDE OIL, BIODEGRADATION, OIL SPILLS, FATE, OXIDATION, TAR,

0870 EVAPORATION, BIODEGRADATION, MODELS, HYDROCARBONS, OIL SPILLS, OCEANS, FATE, SPREADING,

0876 EVAPORATION, EMULSIFICATION, CRUDE OIL, ARCTIC, OIL SPILLS, FATE, WEATHERING, SOLUTION, TAR

0875 EVAPORATION, CRUDE OIL, OIL SPILLS, WEATHERING, TAR, SOLUTION, *SULFUR COMPOUNDS,

0877 EVAPORATION, CRUDE OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS, BIODEGRADATION, OXIDATION, *PHOTOOXIDATION

0871 EXPLORATION, DRILLING, OIL INDUSTRY, MICHIGAN, [illegible] SANCTUARY

0362 EXPLORATION, ECONOMICS, REGULATIONS, POLLUTION CONTROL, OIL INDUSTRY, REFINING, PRODUCTION,

0881 EXPLORATION, POLLUTION CONTROL, SEAWATER.
0881 EXPLORATION, ENVIRONMENTAL EFFECTS, ARCTIC, PRODUCTION, PLANTS, WILDLIFE, OIL SPILLS, MARINE ORGANISMS.
0928 EXPLORATION, EPA, DRILLING, GUIDELINES, PRODUCTION, WASTEWATERS, *ONSHORE POINT SOURCE CATEGORY.
0047 EXTRACTION, CONTAMINANTS, CHROMATOGRAPHY, ANALYTICAL TECHNIQUES, OIL SHALE, BY-PRODUCT WATERS.
0097 EXTRACTION, CONTAMINANTS, CHEMICAL ANALYSIS, WASTEWATERS, *SOLVENT IR SPECTROPHOTOMETRY.
0095 EXTRACTION, ANALYTICAL TECHNIQUES, SPECTROMETRY, SOLVENTS, DETERGENTS, *OIL-IN-WATER.
0097 EXTRACTION, DESIGN-ENGINEERING, CONTAMINANTS, WASTEWATER TREATMENT, PATENT.
0850 EXTRACTION, ENVIRONMENTAL EFFECTS, OIL SHALE, PRODUCTION, SOLID WASTES, WASTEWATERS.
0897 EXTRACTION, ENVIRONMENTAL EFFECTS, DEVELOPMENT, OIL SHALE.
0995 EXTRACTION, EPA, GUIDELINES, PRODUCTION, OIL INDUSTRY, WASTEWATERS, *ONSHORE POINT SOURCE CATEGORY.
0510 FATE, ESTUARIES, CHEMICAL ANALYSIS, OIL SPILLS, FISH, HYDROCARBONS, WEATHERING, *FUNDULUS HETEROCLITUS.
0720 FATE, ENVIRONMENTAL PROTECTION, CONTINGENCY PLANNING, OIL SPILLS, SANTA BARBARA CHANNEL, *CLEAN SEAS INC.
0757 FATE, CONTAMINATION, COASTS, CHRONIC EFFECTS, ANALYTICAL TECHNIQUES, HYDROCARBONS, MARINE ORGANISMS.
0821 FATE, ARGO MERCHANT SPILL, OIL SPILLS, TANKERS, TOXICITY, HYDROCARBONS.
0823 FATE, COST ANALYSIS, CLEANUP, MODELS, OIL SPILLS, MOVEMENT, STATISTICAL ANALYSIS.
0824 FATE, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, OIL SPILLS, TANKERS, MODELS, WILDLIFE, *WORLD WAR II SPILLS.
0828 FATE, ARGO MERCHANT SPILL, OIL SPILLS, TANKERS, HYDROCARBONS, TOXICITY.
0832 FATE, ESTUARIES, ENVIRONMENTAL EFFECTS, CONTAMINATION, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, OIL SPILLS, OCEANS, MARINE ORGANISMS.
0891 FATE, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, PUGET SOUND, MEXICO/GULF OF, HYDROCARBONS, TOXICITY, MARINE ORGANISMS, NOAA.
0893 FATE, ENVIRONMENTAL EFFECTS, ATLANTIC OCEAN, OIL SPILLS, OCS, OIL-GAS LEASING, *RISK ANALYSIS.
0918 FATE, ENVIRONMENTAL EFFECTS, BIODEGRADATION, OIL SPILLS, SOIL.
0940 FATE, CRUDE OIL, BIODEGRADATION, BACTERIA, MONITORING, SAMPLING.
0955 FATE, OIL SPILLS, MOVEMENT, SAMPLING, MONITORING, OCEANS, NOAA.
0957 FATE, EVAPORATION, DISPERSIONS, CRUDE OIL, BIODEGRADATION, OIL SPILLS, OXIDATION, TAR.
0958 FATE, BIOLOGICAL EFFECTS, API, OIL SPILLS, MARINE ORGANISMS.
0961 FATE, CRUDE OIL, CONTAMINATION, OIL SPILLS, INLAND, MODELS, GROUNDWATER.
0964 FATE, CRUDE OIL, CONTAMINATION, OIL SPILLS, INLAND, GROUNDWATER, *PERSISTENCE.
0965 FATE, ESTUARIES, ENVIRONMENTAL EFFECTS, BEACHES, METULA SPILL, TANKERS, MARINE ORGANISMS, MAGELLAN/STRAIT OF.
0969 FATE, EMULSIFICATION, DECOMPOSITION, ADSORPTION, MODELS, OIL SPILLS, HYDROCARBONS, SPREADING, SOLUTION.
0970 FATE, EVAPORATION, BIODEGRADATION, MODELS, HYDROCARBONS, OIL SPILLS, OCEANS, SPREADING.
0971 FATE, CONTAMINATION, API, TOXICITY, OIL SPILLS, MARINE ORGANISMS.
0972 FATE, ESTUARIES, BIODEGRADATION, ATLANTIC COAST, ADSORPTION, HYDROCARBONS, RIVERS, PAH.
0974 FATE, EVAPORATION, EMULSIFICATION, CRUDE OIL, ARCTIC, OIL SPILLS, WEATHERING, SOLUTION, TAR.
0975 FATE, ENVIRONMENTAL EFFECTS, CRUDE OIL, BEHAVIOR, HYDROCARBONS, SEDIMENTS, SOURCES.
0976 FATE, ENVIRONMENTAL EFFECTS, DECOMPOSITION, CARCINOGENS, PAH.
0979 FATE, CHEDABUCTO BAY, BIOLOGICAL EFFECTS, BENTHOS, BEACHES, OIL SPILLS, MOVEMENT, SEDIMENTS, PLANKTON.
0980 FATE, CHEDABUCTO BAY, FUEL OIL, SEDIMENTS, WEATHERING, HYDROCARBONS, METABOLISM, MOLLUSKS.
0982 FATE, DRIFT, DELAWARE BAY, OIL SPILLS, MODELS, SPREADING.
1003 FATE, CRUDE OIL, CHROMATOGRAPHY, CARCINOGENS, BIBLIOGRAPHIES, ANALYTICAL TECHNIQUES, PAH, SOURCES, SPECTROSCOPY.
0987 FEA, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, CRUDE OIL, REGULATIONS, PETROLEUM PRODUCTS, *MANDATORY OIL IMPORT [illegible].
0607 FILTRATION, OIL-WATER SEPARATION, WASTEWATER TREATMENT, FLOTATION.
0678 FILTRATION, WASTEWATER TREATMENT, REFINERIES, OIL-WATER SEPARATION.
0680 FILTRATION, FILTERS, WASTEWATER TREATMENT, OIL-WATER SEPARATION, *TUBULAR ULTRAFILTRATION SYSTEM.
0510 FISH, FATE, ESTUARIES, CHEMICAL ANALYSIS, OIL SPILLS, HYDROCARBONS, WEATHERING, *FUNDULUS HETEROCLITUS.
0537 FISH, CHROMATOGRAPHY, CHEMICAL ANALYSIS, HYDROCARBONS, MARINE ORGANISMS.
0560 FISH, CHROMATOGRAPHY, CHEMICAL ANALYSIS, HYDROCARBONS, MARINE ORGANISMS, *SHRIMP, SQUID, *N-PARAFFINS.
0758 FISH, ESTUARIES, BIOLOGICAL EFFECTS, BENTHOS, ATLANTIC COAST, OIL SPILLS, WEATHERING, PLANKTON.
0759 FISH, CONTAMINATION, BENTHOS, BEHAVIOR, BUNKER OIL, *OIL-CONTAINING PREY, *FEEDING.
0762 FISH, ESTUARIES, CONTAMINATION, HYDROCARBONS, *MICROSOMAL MIXED FUNCTION OXIDASES, *FUNDULUS HETEROCLITUS.
0766 FISH, CANADA, WASTEWATERS, REFINERIES, TOXICITY, *AQUATIC LIFE.
0771 FISH, DISTRIBUTION, BEHAVIOR, *NAPHTHALENES, *[illegible], *[illegible], *[illegible], *FUNDULUS SIMILIS

0798 FISH, BIOLOGICAL EFFECTS, AROMATIC HYDROCARBONS, [illegible], [illegible]

0790 FISH, WASTEWATERS, REFINERIES, TOXICITY, FRESHWATER, INVERTEBRATES, *LETHAL CONCENTRATION

0800 FISH, BIOLOGICAL EFFECTS, OIL SPILLS, FUEL OIL, RESTORATION, STREAMS, INVERTEBRATES, NEW MEXICO

0803 FISH, CRUDE OIL, ALASKA, FUEL OIL, TOXICITY, MARINE ORGANISMS, INVERTEBRATES, INTERTIDAL ZONE

0806 FISH, [illegible], CRUDE OIL, CHRONIC EFFECTS, MARINE ORGANISMS, HYDROCARBONS, *FLOW-THROUGH SYSTEM

0810 FISH, CONTAMINATION, BIOLOGICAL EFFECTS, HYDROCARBONS, METABOLISM,

0817 FISH, ESTUARIES, CRUDE OIL, BIOLOGICAL EFFECTS, METABOLISM, [illegible]

0830 FISH, DEVELOPMENT, BIOLOGICAL EFFECTS, OIL SHALE, WILDLIFE, *US FISH & WILDLIFE SERVICE

0878 FISH, ENVIRONMENTAL EFFECTS, ALASKA, OFFSHORE DEVELOPMENT, OCS, MOLLUSKS, HABITAT, BASELINE STUDIES

0860 FISHERIES, ECONOMIC EFFECTS, CARIBBEAN SEA, OIL SPILLS, SOCIAL EFFECTS, GUATEMALA,

0857 FISHERIES, ENVIRONMENTAL EFFECTS, OIL SPILLS, OFFSHORE DRILLING, MARINE ORGANISMS, *GEORGES BANK

0858 FISHERIES, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, US, REGULATIONS, OIL INDUSTRY,

0860 FISHERIES, COASTS, OFFSHORE DRILLING, OIL SPILLS, NEW YORK,

0879 FISHERIES, ENVIRONMENTAL EFFECTS, BENTHOS, ALASKA, OFFSHORE DEVELOPMENT, OCS, PLANKTON BASELINE STUDIES

0888 FISHERIES, ECONOMIC EFFECTS, ATLANTIC COAST, OIL SPILLS, OFFSHORE DEVELOPMENT,

0868 FLOCCULATION, EMULSIONS, DESIGN-ENGINEERING, OIL-WATER SEPARATION, PRECIPITATION,

0871 FLOCCULATION, CONTAMINANTS, WASTEWATER TREATMENT, *FLOCCULANT-POLYELECTROLYTES,

0887 FLOCCULATION, EMULSIONS, OIL-WATER SEPARATION, WASTEWATERS, REFINERIES,

0842 FLORIDA, ENVIRONMENTAL EFFECTS, PORTS, OIL TRANSFER, MEXICO/GULF OF, SOCIO-ECONOMIC EFFECTS, LEGISLATION, *DEEPWATER PORTS

0849 FLORIDA, ESTUARIES, ENVIRONMENTAL EFFECTS, ANIMALS, OIL TRANSPORT, PIPELINES, PLANTS, MONITORING

0855 FLORIDA, ECONOMIC EFFECTS, OFFSHORE EXPLORATION, OIL-GAS LEASING, ONSHORE IMPACTS,

0857 FLORIDA, OFFSHORE EXPLORATION, OFFSHORE DEVELOPMENT, SOCIO-ECONOMIC EFFECTS, ONSHORE IMPACTS

0858 FLORIDA, ENVIRONMENTAL EFFECTS, COASTS, OFFSHORE DEVELOPMENT, ONSHORE IMPACTS, SOCIO-ECONOMIC EFFECTS, REFINERIES, PORTS, GUIDELINES

0859 FLORIDA, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, OCS, OIL SPILLS, PIPELINES,

0787 FLORIDA COAST, CORAL REEFS, BIOLOGICAL EFFECTS, OIL SPILLS, TROPICAL REGIONS, MARINE ORGANISMS, INTERTIDAL ZONE, [illegible]

0697 FLOTATION, FILTRATION, OIL-WATER SEPARATION, WASTEWATER TREATMENT,

0699 FLOTATION, DESIGN-ENGINEERING, COALESCENCE, WASTEWATER TREATMENT, OIL-WATER SEPARATION, PATENT

0700 FLOTATION, WASTEWATER TREATMENT, OIL-WATER SEPARATION, PATENT,

0881 FOOD WEB, DISTRIBUTION, HYDROCARBONS, OIL TRANSFER, OCEANS, MARINE ORGANISMS, *TRANSFER PROCESSES

0768 FOOD WEB, CONTAMINATION, AROMATIC HYDROCARBONS, ACCUMULATION, WASTEWATERS, REFINERIES, MOLLUSKS, *FOOD CHAIN, *3,4-BENZOPYRENE

0770 FOOD WEB, CHEMICAL ANALYSIS, BIRDS, BIOLOGICAL EFFECTS, HYDROCARBONS, METABOLISM, EGGS

0802 FRANCE, BOOMS, OIL SPILLS, RECOVERY, SKIMMERS, STORAGE,

0848 FRANCE, EUROPE, DENMARK, OFFSHORE DEVELOPMENT, LIABILITY, UK, NORWAY, *POLLUTION DAMAGE

0790 FRESHWATER, FISH, WASTEWATERS, REFINERIES, TOXICITY, INVERTEBRATES, *LETHAL CONCENTRATION

0809 FRESHWATER, CRUDE OIL, ALGAE, *NAPHTHALENE, TOXICITY, METABOLISM, *CHLAMYDOMONAS ANGULOSA

0911 FRESHWATER, ECOSYSTEMS, BIODEGRADATION, HYDROCARBONS, MICROORGANISMS,

0919 FRESHWATER, COASTS, BIODEGRADATION, BACTERIA, HYDROCARBONS, OIL SLICKS,

0920 FRESHWATER, BIODEGRADATION, FUEL OIL, MICROORGANISMS, *CONTINUOUS CULTURE

0920 FUEL OIL, CRUDE OIL, CANADA, OIL SPILLS, RECOVERY, SKIMMERS, OIL-WATER SEPARATION,

0755 FUEL OIL, BIRDS, BIOLOGICAL EFFECTS, MONITORING, *REPRODUCTION

0756 FUEL OIL, CRUSTACEANS, BIOLOGICAL EFFECTS, BEHAVIOR, *BENZENE, MOLLUSKS, *SUBLETHAL EFFECTS, *LOBSTER, *MUD SNAIL

0790 FUEL OIL, CRUDE OIL, BENTHOS, ALGAE, TOXICITY, WASTE OIL, METABOLISM,

0792 FUEL OIL, BIOLOGICAL EFFECTS, PLANTS, TROPICAL REGIONS, MALAYSIA, *PIONEER MANGROVE, *AVICENNIA INTERMEDIA

0800 FUEL OIL, FISH, BIOLOGICAL EFFECTS, OIL SPILLS, RESTORATION, STREAMS, INVERTEBRATES, NEW MEXICO

0802 FUEL OIL, CONTAMINATION, BIOLOGICAL EFFECTS, SEDIMENTS, POLYCHAETES, METABOLISM, *FEEDING ACTIVITY, *ARENICOLA MARINA

0803 FUEL OIL, FISH, CRUDE OIL, ALASKA, TOXICITY, MARINE ORGANISMS, INVERTEBRATES, INTERTIDAL ZONE

0805 FUEL OIL, BIOLOGICAL EFFECTS, HYDROCARBONS, POLYCHAETES, UPTAKE, METABOLISM, *NEANTHES ARENACEODENTATA

0807 FUEL OIL, ESTUARIES, DELAWARE, TOXICITY, MARINE ORGANISMS, *ULTRA-VIOLET RADIATION,

0816 FUEL OIL, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, DISPERSANTS, MARINE ORGANISMS,
[illegible]
[illegible] FUEL OIL: BIODEGRADATION, [illegible] MICROORGANISMS, *CONTINUOUS CULTURE,
[illegible] FUEL OIL: [illegible]
[illegible] FUEL OIL: [illegible]
[illegible] FUEL OIL: FATE, CHESAPEAKE BAY, SEDIMENTS, WEATHERING, HYDROCARBONS, METABOLISM,
MOLLUSKS
1002 FUEL OIL: ANALYSIS, BIBLIOGRAPHIES, ANALYTICAL TECHNIQUES, TAR, PETROLEUM PRODUCTS,
[illegible] FUELS: CHROMATOGRAPHY, CHEMICAL ANALYSIS, HYDROCARBONS, PETROLEUM PRODUCTS,
PETROCHEMICALS, WASTEWATERS
[illegible] FUELS: PETROLEUM PRODUCTS, TOXICITY, PHYTOPLANKTON,
[illegible] FUELS: BIODEGRADATION, MICROORGANISMS, *SUPERSONIC AIRCRAFT FUEL,
[illegible] GASOLINE: CONTAMINATION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, GROUNDWATER,
[illegible] GASOLINE: CONTAINMENT, LEAKAGE, OIL TANKS, RECOVERY, GROUNDWATER,
0721 GASOLINE: CONTINGENCY PLANNING, CLEANUP, OIL SPILLS, OIL INDUSTRY, *STANDARD OIL CO.
INDIANA
0926 GASOLINE: BIODEGRADATION, GROUNDWATER, NUTRIENT ADDITION,
0927 GASOLINE: BIODEGRADATION, GROUNDWATER, PENNSYLVANIA, NUTRIENT ADDITION,
0985 GERMANY, WEST, ECONOMICS, WASTEWATER TREATMENT, PETROCHEMICALS, LEGISLATION,
0501 GOVERNMENT AGENCIES, EPA, MONITORING, HYDROCARBONS, OIL SPILLS, POLLUTION CONTROL,
SURVEILLANCE, USGS, USCG, BOM
0847 GOVERNMENT AGENCIES, ENVIRONMENTAL DETERIORATION, DELAWARE, OFFSHORE DEVELOPMENT, OIL
INDUSTRY, OIL SPILLS, *COASTAL RECREATION
0477 GREAT LAKES, COASTS, OIL SPILLS, US, STATISTICAL ANALYSIS, MODELS, *DISCRIMINANT
ANALYSIS
0919 GROUNDWATER: CONTAMINATION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, GASOLINE,
0921 GROUNDWATER: COST ANALYSIS, CONTINGENCY PLANNING, OIL SPILLS, RECOVERY, HYDROCARBONS,
0922 GROUNDWATER: GASOLINE, CONTAINMENT, LEAKAGE, OIL TANKS, RECOVERY,
0956 GROUNDWATER: ENVIRONMENTAL EFFECTS, CRUDE OIL, STORAGE, OIL SPILLS, VEGETATION,
LOUISIANA, TEXAS, SALT DOMES
0926 GROUNDWATER: GASOLINE, BIODEGRADATION, NUTRIENT ADDITION,
0927 GROUNDWATER: GASOLINE, BIODEGRADATION, PENNSYLVANIA, NUTRIENT ADDITION,
0942 GROUNDWATER: CRUDE OIL, BIODEGRADATION, MICROORGANISMS, HYDROCARBONS, PETROLEUM
PRODUCTS, USSR
0951 GROUNDWATER: AERATION, OIL SPILLS, HYDROCARBONS, *SURFACE WATERS, *WATER-SOLUBLE
FRACTIONS
0961 GROUNDWATER: FATE, CRUDE OIL, CONTAMINATION, OIL SPILLS, INLAND, MODELS,
0962 GROUNDWATER: FATE, CRUDE OIL, CONTAMINATION, OIL SPILLS, INLAND, PERSISTENCE,
0966 GROUNDWATER: CONTAMINATION, HYDROCARBONS, MOVEMENT, POLLUTION CONTROL,
0974 GUIDELINES: ACTIVATED SLUDGE, REFINERIES, WASTEWATER TREATMENT,
0865 GUIDELINES: ENVIRONMENTAL EFFECTS, BLM, ATLANTIC OCEAN, OFFSHORE DRILLING, OCS,
MONITORING
0888 GUIDELINES: FLORIDA, ENVIRONMENTAL EFFECTS, COASTS, OFFSHORE DEVELOPMENT, ONSHORE
IMPACTS, SOCIO-ECONOMIC EFFECTS, REFINERIES, PORTS
0993 GUIDELINES: EUROPE, OIL INDUSTRY, REGULATIONS, PIPELINES, WASTEWATERS,
0994 GUIDELINES: EXPLORATION, EPA, DRILLING, PRODUCTION, WASTEWATERS, *ONSHORE POINT
SOURCE CATEGORY
0995 GUIDELINES: EXTRACTION, EPA, PRODUCTION, OIL INDUSTRY, WASTEWATERS, *ONSHORE POINT
SOURCE CATEGORY
0996 GUIDELINES: DISTRIBUTION, WASTEWATER TREATMENT, PRODUCTION, STORAGE, OIL-WATER
SEPARATION, POLLUTION CONTROL
0937 GUIDELINES: ECONOMICS, WASTEWATER TREATMENT, OIL INDUSTRY, REFINERIES, LEGISLATION,
WATER QUALITY
0878 HABITAT, FISH, ENVIRONMENTAL EFFECTS, ALASKA, OFFSHORE DEVELOPMENT, OCS, MOLLUSKS,
BASELINE STUDIES
0545 HARBORS, DISTRIBUTION, CONTAMINATION, SAMPLING, HYDROCARBONS, *EXTRACTABLE ORGANICS,
NEW YORK
0578 HARBORS: DESIGN-ENGINEERING, OIL SPILLS, RECOVERY, *CLEAN SWEEP,
[illegible] HARBORS: ESTUARIES, DESIGN-ENGINEERING, OIL SPILLS, RECOVERY, *CLEAN SWEEP,
0708 HARBORS: CLEANUP, OIL SPILLS, SKIMMERS, [illegible] DEBRIS, HANDLING SYSTEM,
0818 HARBORS: ESTUARIES, EPA, DESIGN-ENGINEERING, ABSORPTION, OIL SPILLS, RECOVERY, RIVERS,
SUMMARY
0288 HARBORS, DRIFT, MODELS, OIL SPILLS, SPREADING, NEW YORK
0868 HEALTH HAZARDS, ENVIRONMENTAL DETERIORATION, ATLANTIC OCEAN, OFFSHORE DEVELOPMENT,
OCS, HYDROCARBONS
0903 HYDROCARBONS: CHEMICAL ANALYSIS, ALASKA/GULF OF, NATURAL SEEPAGE,
0466 HYDROCARBONS: SOURCES, OCEANS, NATURAL SEEPAGE, *BIOGENIC HYDROCARBONS, *INPUT
ESTIMATES
0872 HYDROCARBONS: DISTRIBUTION, SOURCES, INDUSTRIES, REFINERIES, *MUNICIPAL DISCHARGES,
RUNOFF
0490 HYDROCARBONS, CONTAMINANTS, ANALYTICAL TECHNIQUES, MONITORING, OCEANS, TAR, SAMPLING,
MARINE ORGANISMS
0931 HYDROCARBONS: DESIGN-ENGINEERING, MONITORING, OIL-IN-WATER, *FLUORESCENCE,
[illegible] HYDROCARBONS: DISTRIBUTION, [illegible] EPA, MONITORING, WATER QUALITY,
0936 HYDROCARBONS: DISTRIBUTION, MONITORING, OCEANS, SURVEILLANCE,

0501 HYDROCARBONS, GOVERNMENT AGENCIES, EPA, MONITORING, OIL SPILLS, POLLUTION CONTROL, SURVEILLANCE, [illegible]
0502 HYDROCARBONS, DETECTION, OCEAN ENGINEERING, MONITORING, PATENT.
0506 HYDROCARBONS, CHEMICAL ANALYSIS, CALIFORNIA/SOUTHERN, MONITORING, SEDIMENTS, SOURCE IDENTIFICATION.
0509 HYDROCARBONS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, MONITORING, MARINE ORGANISMS, INTERTIDAL ZONE, [illegible] *BIOGENIC HYDROCARBONS.
0520 HYDROCARBONS, CHEMICAL ANALYSIS, SAMPLING, PACIFIC OCEAN, TANKER ROUTES.
0521 HYDROCARBONS, DISTRIBUTION, SAMPLING, PACIFIC OCEAN, TANKER ROUTES.
0522 HYDROCARBONS, DISTRIBUTION, CHEMICAL ANALYSIS, SAMPLING, SEDIMENTS, SOURCES, MEXICO/GULF OF.
0524 HYDROCARBONS, DISTRIBUTION, BACTERIA, SAMPLING, MICROORGANISMS, TAR, SEDIMENTS, OFFSHORE DEVELOPMENT, NORTH SEA.
0525 HYDROCARBONS, HARBORS, DISTRIBUTION, CONTAMINATION, SAMPLING, *EXTRACTABLE ORGANICS, NEW YORK.
0526 HYDROCARBONS, CHEMICAL ANALYSIS, BENTHOS, SAMPLING, SEDIMENTS, UPTAKE, TAR, *[illegible] DEPTHS.
0529 HYDROCARBONS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SEAWATER.
0530 HYDROCARBONS, FISH, FATE, ESTUARIES, CHEMICAL ANALYSIS, OIL SPILLS, WEATHERING, *FUNDULUS HETEROCLITUS.
0532 HYDROCARBONS, DISTRIBUTION, CHEMICAL ANALYSIS, ZOOPLANKTON, SOURCES, MEXICO/GULF OF, *BIOGENIC HYDROCARBONS.
0533 HYDROCARBONS, CHEMICAL ANALYSIS, *PHENOLS, *SURFACE WATERS.
0537 HYDROCARBONS, FISH, CHROMATOGRAPHY, CHEMICAL ANALYSIS, MARINE ORGANISMS.
0538 HYDROCARBONS, CHEMICAL ANALYSIS, OCEANS, SAMPLING.
0539 HYDROCARBONS, CHROMATOGRAPHY, ALGAE, SEDIMENTS, MEXICO/GULF OF, MISSISSIPPI RIVER, SAMPLING.
0540 HYDROCARBONS, FISH, CHROMATOGRAPHY, CHEMICAL ANALYSIS, MARINE ORGANISMS, *SHRIMP, *SQUID, *N-PARAFFINS.
0541 HYDROCARBONS, CHEMICAL ANALYSIS, *INDUSTRIAL ORGANIC COMPOUNDS, *TENNESSEE RIVER.
0542 HYDROCARBONS, FUELS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, PETROLEUM PRODUCTS, PETROCHEMICALS, WASTEWATERS.
0543 HYDROCARBONS, DETECTION, ANALYTICAL TECHNIQUES.
0545 HYDROCARBONS, CONTAMINANTS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, WASTEWATERS, *LIQUID CHROMATOGRAPHY.
0546 HYDROCARBONS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SPECTROMETRY, SEDIMENTS, INTERTIDAL ZONE, *WATER ANALYSIS.
0548 HYDROCARBONS, DELAWARE, WASTEWATERS, REFINERIES, *OIL CONTENT, *URBAN RUNOFF, *DELAWARE ESTUARY.
0549 HYDROCARBONS, DETECTION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SEDIMENTS, SOLVENTS, *N-PARAFFINS.
0550 HYDROCARBONS, CRUDE OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS, *EELS, *ORGANIC SULFIDES.
0552 HYDROCARBONS, CRUDE OIL, CONTAMINATION, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, *WATER SOLUBLE FRACTION.
0558 HYDROCARBONS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, PAH, SOIL, *THIN-LAYER CHROMATOGRAPHY.
0560 HYDROCARBONS, DETECTION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SOURCES, SEDIMENTS, LAKES, WASHINGTON.
0561 HYDROCARBONS, DELAWARE, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, WASTEWATERS, REFINERIES, *SEWAGE, *URBAN RUNOFF, REGULATIONS.
0562 HYDROCARBONS, CHEMICAL ANALYSIS.
0563 HYDROCARBONS, EVAPORATION, CRUDE OIL, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SPECTROMETRY, PETROLEUM PRODUCTS, *WATER SOLUBLE FRACTIONS.
0568 HYDROCARBONS, DISTRIBUTION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, SPECTROMETRY, SARGASSO SEA.
0591 HYDROCARBONS, GROUNDWATER, COST ANALYSIS, CONTINGENCY PLANNING, OIL SPILLS, RECOVERY.
0593 HYDROCARBONS, DISPERSANTS, CLEANUP, BIODEGRADATION, OIL SLICKS, PATENT, *NITROGEN COMPOUNDS.
0594 HYDROCARBONS, DISPERSANTS, CLEANUP, BIODEGRADATION, OIL SLICKS, PATENT, *NITROGEN COMPOUNDS.
0595 HYDROCARBONS, DISPERSANTS, CLEANUP, BIODEGRADATION, OIL SLICKS, PATENT, *NITROGEN COMPOUNDS.
0605 HYDROCARBONS, CLEANUP, BIODEGRADATION, BACTERIA, OIL SPILLS, PATENT.
0641 HYDROCARBONS, FOOD WEB, DISTRIBUTION, OIL TRANSFER, OCEANS, MARINE ORGANISMS, *TRANSFER PROCESSES.
0669 HYDROCARBONS, DISPOSAL, BIODEGRADATION, OIL SPILLS, MANUALS, *DEBRIS.
0691 HYDROCARBONS, CONTAMINANTS, WASTEWATER TREATMENT, *VACUUM STRIPPING.
0757 HYDROCARBONS, FATE, CONTAMINATION, COASTS, CHRONIC EFFECTS, ANALYTICAL TECHNIQUES, MARINE ORGANISMS.
0762 HYDROCARBONS, FISH, ESTUARIES, CONTAMINATION, *MICROSOMAL MIXED FUNCTION OXIDASES, *FUNDULUS HETEROCLITUS.
0770 HYDROCARBONS, FOOD WEB, CHEMICAL ANALYSIS, BIRDS, BIOLOGICAL EFFECTS, METABOLISM, *EGGS.
0778 HYDROCARBONS, MOLLUSKS, UPTAKE, RELEASE, PLATFORMS, SEDIMENTS, TEXAS, *TRINITY BAY, *NAPHTHALENES, *CLAM, *RANGIA CUNEATA.
0784 HYDROCARBONS, ECOSYSTEMS, CRUDE OIL, TOXICITY, PETROLEUM PRODUCTS, MARINE ORGANISMS,

0721 HYDROCARBONS, CONTAMINATION, CHRONIC EFFECTS, ANIMALS, *IMMUNOLOGICAL RESPONSE,
[illegible] HYDROCARBONS, BIOCHEMICAL EFFECTS, [illegible], MARINE ORGANISMS,
0798 HYDROCARBONS, CONTAMINATION, BIOLOGICAL EFFECTS, MOLLUSKS, *SCALLOPS, *OYSTER TASMANIA,
0799 HYDROCARBONS, TOXICITY, PETROLEUM PRODUCTS,
0801 HYDROCARBONS, FATE, METABOLITES, MARINE ORGANISMS, *BENZO(A)PYRENE, *MICROSOMAL MIXED-FUNCTION OXIDASES,
0804 HYDROCARBONS, UPTAKE, METABOLISM, RELEASE, POLYCHAETES, SEDIMENTS, SEAWATER, *NEANTHES ARENACEODENTATA,
0805 HYDROCARBONS, FUEL OIL, BIOLOGICAL EFFECTS, POLYCHAETES, UPTAKE, METABOLISM, *NEANTHES ARENACEODENTATA,
0806 HYDROCARBONS, FISH, DESIGN-ENGINEERING, CRUDE OIL, CHRONIC EFFECTS, MARINE ORGANISMS, *FLOW-THROUGH SYSTEM,
0810 HYDROCARBONS, FISH, CONTAMINATION, BIOLOGICAL EFFECTS, METABOLISM,
0821 HYDROCARBONS, FATE, ARGO MERCHANT SPILL, OIL SPILLS, TANKERS, TOXICITY,
0830 HYDROCARBONS, ENVIRONMENTAL EFFECTS, DISPERSANTS, CLEANUP, OIL SPILLS, SHORELINES, PORTUGAL,
0848 HYDROCARBONS, FATE, ARGO MERCHANT SPILL, OIL SPILLS, TANKERS, TOXICITY,
0868 HYDROCARBONS, HEALTH HAZARDS, ENVIRONMENTAL DETERIORATION, ATLANTIC OCEAN, OFFSHORE DEVELOPMENT, OCS,
0871 HYDROCARBONS, ENVIRONMENTAL EFFECTS, OFFSHORE PRODUCTION, OIL INDUSTRY, MARINE ORGANISMS, SEDIMENTS, LOUISIANA,
0880 HYDROCARBONS, ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, BIODEGRADATION, ALASKA, OFFSHORE DEVELOPMENT, OCS, MARINE ORGANISMS,
0881 HYDROCARBONS, ENVIRONMENTAL EFFECTS, DISTRIBUTION, CHEMICAL ANALYSIS, ALASKA, OFFSHORE DEVELOPMENT, OCS, MICROORGANISMS, *BASELINE STUDIES,
0882 HYDROCARBONS, ENVIRONMENTAL EFFECTS, DISTRIBUTION, BIODEGRADATION, ALASKA, OFFSHORE DEVELOPMENT, OCS, *BASELINE STUDIES,
0891 HYDROCARBONS, FATE, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, PUGET SOUND, MEXICO/GULF OF, TOXICITY, MARINE ORGANISMS, NOAA,
0908 HYDROCARBONS, CLEANUP, BIODEGRADATION, BACTERIA, OIL SLICKS, *NUTRIENT ENRICHMENT,
0909 HYDROCARBONS, BIODEGRADATION, SOIL, OXIDATION, MICROORGANISMS, *OXYGEN UPTAKE RATE,
0911 HYDROCARBONS, FRESHWATER, ECOSYSTEMS, BIODEGRADATION, MICROORGANISMS,
0912 HYDROCARBONS, BIODEGRADATION, BACTERIA, OIL SLICKS, *SUPERMICROBES,
0915 HYDROCARBONS, FRESHWATER, COASTS, BIODEGRADATION, BACTERIA, OIL SLICKS,
0916 HYDROCARBONS, BIODEGRADATION, BACTERIA, SEDIMENTS, SEAWATER, NARRAGANSETT BAY, RHODE ISLAND,
0917 HYDROCARBONS, BIODEGRADATION, BACTERIA, METABOLISM, SALICYLIC COMPOUNDS,
0920 HYDROCARBONS, BIODEGRADATION, BACTERIA, *OCT-PLASMID MICROORGANISMS,
0921 HYDROCARBONS, BIODEGRADATION, OXIDATION, SOIL BIODEGRADATION RATE,
0928 HYDROCARBONS, CRUDE OIL, BIODEGRADATION, ANALYTICAL TECHNIQUES, *PETROLEUM VARIETIES,
0929 HYDROCARBONS, BIODEGRADATION, MICROORGANISMS,
0931 HYDROCARBONS, BIODEGRADATION, BENTHOS, METABOLISM, SEDIMENTS, MICROORGANISMS, MARINE ORGANISMS,
0932 HYDROCARBONS, BIODEGRADATION, MICROORGANISMS, SEAWATER,
0933 HYDROCARBONS, BIODEGRADATION, BACTERIA, SEAWATER, *HEXADECANE, *ORGANIC SUBSTANCES,
0937 HYDROCARBONS, BIODEGRADATION, METABOLISM, MICROORGANISMS,
0942 HYDROCARBONS, GROUNDWATER, CRUDE OIL, BIODEGRADATION, MICROORGANISMS, PETROLEUM PRODUCTS, USSR,
0943 HYDROCARBONS, BIODEGRADATION, SOIL, MONITORING, MODELS,
0948 HYDROCARBONS, BIODEGRADATION, METABOLISM, MICROORGANISMS, *BUTADIENE,
0950 HYDROCARBONS, EVAPORATION, OIL SPILLS, SOLUTION,
0953 HYDROCARBONS, GROUNDWATER, BEHAVIOR, OIL SPILLS, *SURFACE WATERS, *WATER-SOLUBLE FRACTIONS,
0960 HYDROCARBONS, REFINERIES, MEDITERRANEAN SEA, SAMPLING, *SURFACE MICROLAYER COMPOSITION,
0966 HYDROCARBONS, GROUNDWATER, CONTAMINATION, MOVEMENT, POLLUTION CONTROL,
0969 HYDROCARBONS, FATE, EMULSIFICATION, DECOMPOSITION, ADSORPTION, MODELS, OIL SPILLS, SPREADING, SOLUTION,
0970 HYDROCARBONS, FATE, EVAPORATION, BIODEGRADATION, MODELS, OIL SPILLS, OCEANS, SPREADING,
0972 HYDROCARBONS, FATE, ESTUARIES, BIODEGRADATION, ATLANTIC COAST, ADSORPTION, RIVERS, [illegible]
0976 HYDROCARBONS, FATE, ENVIRONMENTAL EFFECTS, CRUDE OIL, BEHAVIOR, SEDIMENTS, SOURCES,
0980 HYDROCARBONS, FUEL OIL, FATE, CHEDABUCTO BAY, SEDIMENTS, WEATHERING, METABOLISM, MOLLUSKS,
0981 HYDROCARBONS, DISTRIBUTION, SEDIMENTS, LAKES,
0614 ICE, DESIGN-ENGINEERING, CANADA, ARCTIC, OIL SPILLS, RECOVERY, *CLEAN SWEEP,
0729 ICE, CONTINGENCY PLANNING, CLEANUP, BEAUFORT SEA, OIL SPILLS,
0761 ICE, DISPERSANTS, CONTAINMENT, BLOWOUT PREVENTION, OIL SPILLS, OFFSHORE DRILLING, INCINERATION,
0886 ICE, ENVIRONMENTAL EFFECTS, ARCTIC OCEAN, ALASKA, OFFSHORE DEVELOPMENT, OCS, *BASELINE STUDIES,
0957 ICE, CRUDE OIL, SPREADING, *OIL-ON-ICE,
0961 ICE, ENVIRONMENTAL EFFECTS, CANADA, BEHAVIOR, ARCTIC, OIL SPILLS, MOVEMENT, OFFSHORE DRILLING, *BLOWOUTS, [illegible]
0963 ICE, OIL SLICKS, SPREADING, CURRENTS,
0717 IMCO, ENVIRONMENTAL PROTECTION, OIL SPILLS, TANKERS, COLOMBIA,

0739 IMCO, CONTINGENCY PLANNING, INTERNATIONAL CONVENTIONS, OIL SPILLS, SHIPS, OIL-WATER
SEPARATION, POLLUTION PREVENTION,
0998 IMCO, INTERNATIONAL CONVENTIONS, REGULATIONS, TANKERS, POLLUTION PREVENTION,
0999 IMCO, INTERNATIONAL CONVENTIONS, POLLUTION PREVENTION, OECD,
[illegible] INCINERATION, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, TAR, OIL SPILLS,
[illegible] INCINERATION, WASTE OIL, [illegible]
[illegible] INCINERATION, DISPOSAL, DISPERSANTS, OIL SPILLS, PLASTICS,
0791 INCINERATION, ICE, DISPERSANTS, CONTAINMENT, BLOWOUT PREVENTION, OIL SPILLS, OFFSHORE
DRILLING,
0872 INDUSTRIES, HYDROCARBONS, DISTRIBUTION, SOURCES, REFINERIES, *MUNICIPAL DISCHARGES,
*RUNOFF,
0879 INDUSTRIES, DELAWARE, REFINERIES, *URBAN RUNOFF, *OIL CONTENT, *DELAWARE ESTUARY,
[illegible] INDUSTRIES, WASTEWATER TREATMENT,
0965 INFORMATION SYSTEMS, STATISTICS, OIL DISCHARGES, US,
0904 INFORMATION SYSTEMS, ENVIRONMENTAL EFFECTS, CONTAMINANTS, BIOLOGICAL EFFECTS, ALASKA,
OFFSHORE DEVELOPMENT, OCS, MONITORING,
0611 INLAND, CONTAMINATION, RESTORATION, SOIL, OIL FIELDS, *BRINES,
0724 INLAND, CONTINGENCY PLANNING, CANADA, OIL SPILLS, PERSONNEL TRAINING,
0736 INLAND, ENVIRONMENTAL PROTECTION, SHIPS, TANKERS, OFFSHORE PRODUCTION, MONITORING,
0752 INLAND, ENVIRONMENTAL EFFECTS, CLEANUP, POLLUTION CONTROL, OIL SPILLS, OCEANS,
0952 INLAND, CANADA, BEHAVIOR, OIL SPILLS, STATISTICAL ANALYSIS, WEATHERING, PIPELINES,
0961 INLAND, GROUNDWATER, FATE, CRUDE OIL, CONTAMINATION, OIL SPILLS, MODELS,
0962 INLAND, GROUNDWATER, FATE, CRUDE OIL, CONTAMINATION, OIL SPILLS, PERSISTENCE,
0667 INTERNATIONAL AGREEMENTS, CLEANUP, BIOLOGICAL EFFECTS, OIL SPILLS, POLLUTION
PREVENTION, SURVEILLANCE,
0632 INTERNATIONAL AGREEMENTS, OIL SPILLS, TANKERS, US, REGULATIONS,
1001 INTERNATIONAL AGREEMENTS, BIBLIOGRAPHIES, LEGISLATION, US, OCEANS, SHIPS, OFFSHORE
DRILLING, POLLUTION PREVENTION, OIL SPILLS,
0739 INTERNATIONAL CONVENTIONS, IMCO, CONTINGENCY PLANNING, OIL SPILLS, SHIPS, OIL-WATER
SEPARATION, POLLUTION PREVENTION,
0998 INTERNATIONAL CONVENTIONS, IMCO, REGULATIONS, TANKERS, POLLUTION PREVENTION,
0999 INTERNATIONAL CONVENTIONS, IMCO, POLLUTION PREVENTION, OECD,
0509 INTERTIDAL ZONE, HYDROCARBONS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, MONITORING, MARINE
ORGANISMS, METABOLISM, *BIOGENIC HYDROCARBONS,
0866 INTERTIDAL ZONE, HYDROCARBONS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SPECTROMETRY,
SEDIMENTS, *WATER ANALYSIS,
0767 INTERTIDAL ZONE, FLORIDA COAST, CORAL REEFS, BIOLOGICAL EFFECTS, OIL SPILLS, TROPICAL
REGIONS, MARINE ORGANISMS, MARSHES,
0721 INTERTIDAL ZONE, HYDROCARBONS, BIOLOGICAL EFFECTS, BERMUDA, TAR, MARINE ORGANISMS,
0803 INTERTIDAL ZONE, FUEL OIL, FISH, CRUDE OIL, ALASKA, TOXICITY, MARINE ORGANISMS,
INVERTEBRATES,
0812 INTERTIDAL ZONE, CRUSTACEANS, CRUDE OIL, BIOLOGICAL EFFECTS, *BARNACLES, *CHTHAMALUS
FISSUS,
0814 INTERTIDAL ZONE, CRUDE OIL, BIOLOGICAL EFFECTS, MARINE ORGANISMS,
0815 INTERTIDAL ZONE, FUEL OIL, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, DISPERSIONS, MARINE
ORGANISMS, *SPECIES DIVERSITY,
0790 INVERTEBRATES, FRESHWATER, FISH, WASTEWATERS, REFINERIES, TOXICITY, *LETHAL
CONCENTRATION,
0800 INVERTEBRATES, FUEL OIL, FISH, BIOLOGICAL EFFECTS, OIL SPILLS, RESTORATION, STREAMS,
NEW MEXICO,
0803 INVERTEBRATES, INTERTIDAL ZONE, FUEL OIL, FISH, CRUDE OIL, ALASKA, TOXICITY, MARINE
ORGANISMS,
0861 JAPAN, DISPERSANTS, CRUDE OIL, CLEANUP, BEACHES, OIL SPILLS, TANKERS, SPREADING,
MOVEMENT,
0755 JAPAN, OIL SPILLS, RECOVERY, POLLUTION PREVENTION, *TEST FACILITIES,
0630 JAPAN, ENVIRONMENTAL EFFECTS, DEVELOPMENT, CONTAMINATION, SHORELINES, MARINE
ORGANISMS,
0560 LAKES, HYDROCARBONS, DETECTION, CHROMATOGRAPHY, CHEMICAL ANALYSIS, SOURCES, SEDIMENTS,
WASHINGTON,
0780 LAKES, CRUDE OIL, ALGAE, TOXICITY, VEGETATION, SUBARCTIC REGIONS,
0981 LAKES, HYDROCARBONS, DISTRIBUTION, SEDIMENTS,
0508 LAW ENFORCEMENT, ENVIRONMENTAL PROTECTION, DESIGN-ENGINEERING, REMOTE SENSING, OIL
SPILLS, SHIPS, SURVEILLANCE, USCG,
0512 LAW ENFORCEMENT, EPA, CLEANUP, REMOTE SENSING, OIL SPILLS, POLLUTION CONTROL,
0660 LAW ENFORCEMENT, TANKERS, REGULATIONS, OIL TRANSPORT, WASHINGTON, PUGET SOUND,
0831 LAW ENFORCEMENT, ARGO MERCHANT SPILL, OIL SPILLS, TANKERS, REGULATIONS,
0943 LEAKAGE, CONTINGENCY PLANNING, OFFSHORE DEVELOPMENT, NORTH SEA, OIL SPILLS, [illegible]
0596 LEAKAGE, DETECTION, DESIGN-ENGINEERING, MONITORING, OIL TANKS, PATENT,
0502 LEAKAGE, DETECTION, DESIGN-ENGINEERING, MONITORING, PIPELINES, OIL SLICKS,
WASTEWATERS, PATENT,
0527 LEAKAGE, GROUNDWATER, GASOLINE, CONTAINMENT, OIL TANKS, RECOVERY,
0561 LEAKAGE, DETECTION, PIPELINES, *MINI-COMPUTERS,
0727 LEAKAGE, DESIGN-ENGINEERING, OIL TANKS, SOIL, POLLUTION PREVENTION, STORAGE, PATENT,
0728 LEAKAGE, DETECTION, DESIGN-ENGINEERING, OIL TANKS, PATENT,
0740 LEAKAGE, DETECTION, PETROLEUM PRODUCTS, PATENT,

0751 LEAKAGE, PIPELINES, POLLUTION PREVENTION, PATENT, *SEALING MATERIAL,
0780 LEAKAGE, DETECTION, DESIGN-ENGINEERING, OIL TANKS, PATENT,
0842 LEGISLATION, FLORIDA, ENVIRONMENTAL EFFECTS, PORTS, OIL TRANSFER, MEXICO/GULF OF,
 SOCIO-ECONOMIC EFFECTS, *DEEPWATER PORTS,
0802 LEGISLATION, GERMANY, WEST, ECONOMICS, WASTEWATER TREATMENT, PETROCHEMICALS,
0725 LEGISLATION, EUROPE, POLLUTION CONTROL, OIL DISCHARGES, *MARINE POLLUTION,
0829 LEGISLATION, ENVIRONMENTAL EFFECTS, DEVELOPMENT, CONTAMINATION, COASTS, *ECOLOGY,
0825 LEGISLATION, ENVIRONMENTAL EFFECTS, POLLUTION CONTROL, REGULATIONS, US,
0866 LEGISLATION, ENVIRONMENTAL EFFECTS, ECONOMICS, DELAWARE, US, OCS, OFFSHORE
 DEVELOPMENT, POLLUTION CONTROL,
0868 LEGISLATION, DELAWARE BAY, PORTS, OIL TRANSFER,
0888 LEGISLATION, ECONOMIC EFFECTS, US, POLLUTION CONTROL, REFINERIES, OIL INDUSTRY,
0900 LEGISLATION, COST ANALYSIS, CLEANUP, POLLUTION CONTROL, LIABILITY, *FEDERAL WATER
 POLLUTION CONTROL ACT,
0921 LEGISLATION, COMPENSATION, US, OIL SPILLS, LIABILITY, *SUPER-FUND,
0887 LEGISLATION, GUIDELINES, ECONOMICS, WASTEWATER TREATMENT, OIL INDUSTRY, REFINERIES,
 WATER QUALITY,
1001 LEGISLATION, INTERNATIONAL AGREEMENTS, BIBLIOGRAPHIES, US, OCEANS, SHIPS, OFFSHORE
 DRILLING, POLLUTION PREVENTION, OIL SPILLS,
0848 LIABILITY, FRANCE, EUROPE, DAMAGES, OFFSHORE DEVELOPMENT, UK, NORWAY, *POLLUTION
 DAMAGE,
0900 LIABILITY, LEGISLATION, COST ANALYSIS, CLEANUP, POLLUTION CONTROL, *FEDERAL WATER
 POLLUTION CONTROL ACT,
0921 LIABILITY, LEGISLATION, COMPENSATION, US, OIL SPILLS, *SUPER-FUND,
0843 LOUISIANA, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, *BAYOU CHOCTAW SALT DOMES,
0844 LOUISIANA, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, *COTE BLANCHE MINE,
0845 LOUISIANA, ENVIRONMENTAL EFFECTS, EIS, CRUDE OIL, STORAGE, *WEEKS ISLAND MINE,
0858 LOUISIANA, GROUNDWATER, ENVIRONMENTAL EFFECTS, CRUDE OIL, STORAGE, OIL SPILLS,
 VEGETATION, TEXAS, *SALT DOMES,
0871 LOUISIANA, HYDROCARBONS, ENVIRONMENTAL EFFECTS, OFFSHORE PRODUCTION, OIL INDUSTRY,
 MARINE ORGANISMS, SEDIMENTS,
0727 LUBRICATING OIL, WASTE OIL, RECLAMATION, PATENT,
0758 LUBRICATING OIL, POLLUTION CONTROL, PATENT,
0759 LUBRICATING OIL, POLLUTION PREVENTION, PATENT,
0865 MAGELLAN/STRAIT OF, FATE, ESTUARIES, ENVIRONMENTAL EFFECTS, BEACHES, METULA SPILL,
 TANKERS, MARINE ORGANISMS,
0772 MAINE, ENVIRONMENTAL EFFECTS, CONTAMINATION, CONTAINMENT, CLEANUP, OIL SPILLS, MARINE
 ORGANISMS, SEDIMENTS, *TAMANO SPILL,
0792 MALAYSIA, FUEL OIL, BIOLOGICAL EFFECTS, PLANTS, TROPICAL REGIONS, *PIONEER MANGROVE,
 *AVICENNIA INTERMEDIA,
0826 MANUALS, CLEANUP, BIOLOGICAL EFFECTS, OIL SPILLS, MARSHES,
0869 MANUALS, HYDROCARBONS, DISPOSAL, BIODEGRADATION, OIL SPILLS, *DEBRIS,
0704 MANUALS, DISPOSAL, WASTE OIL, PETROCHEMICALS, STORAGE, USN,
0775 MARINE MAMMALS, CRUDE OIL, BIOLOGICAL EFFECTS, METABOLISM, *SEALS,
0873 MARINE MAMMALS, ENVIRONMENTAL EFFECTS, ALASKA, OFFSHORE DEVELOPMENT, OCS, *BASELINE
 STUDIES,
0875 MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, CHESAPEAKE BAY, BEACHES, OIL SPILLS, MARSHES,
0920 MARINE ORGANISMS, HYDROCARBONS, CONTAMINANTS, ANALYTICAL TECHNIQUES, MONITORING,
 OCEANS, TAR, SAMPLING,
0909 MARINE ORGANISMS, INTERTIDAL ZONE, HYDROCARBONS, CHROMATOGRAPHY, CHEMICAL ANALYSIS,
 MONITORING, METABOLISM, *AROMATIC HYDROCARBONS,
0937 MARINE ORGANISMS, HYDROCARBONS, FISH, CHROMATOGRAPHY, CHEMICAL ANALYSIS,
0940 MARINE ORGANISMS, HYDROCARBONS, FISH, CHROMATOGRAPHY, CHEMICAL ANALYSIS, *SHRIMP,
 TROPIC, *N-PARAFFINS,
0944 MARINE ORGANISMS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, FAT, *SHELLFISH,
0861 MARINE ORGANISMS, HYDROCARBONS, FOOD USE, DISTRIBUTION, OIL TRANSFER, OCEANS,
 *TRANSFER PROCESSES,
0767 MARINE ORGANISMS, HYDROCARBONS, FATE, CONTAMINATION, COASTS, CHRONIC EFFECTS,
 ANALYTICAL TECHNIQUES,
0786 MARINE ORGANISMS, BIOLOGICAL EFFECTS, OIL SPILLS, RESTORATION, SAN FRANCISCO BAY,
0787 MARINE ORGANISMS, INTERTIDAL ZONE, FLORIDA COAST, CORAL REEFS, BIOLOGICAL EFFECTS, OIL
 SPILLS, TROPICAL REGIONS, HARBORS,
0772 MARINE ORGANISMS, MAINE, ENVIRONMENTAL EFFECTS, CONTAMINATION, CONTAINMENT, CLEANUP,
 OIL SPILLS, SEDIMENTS, *TAMANO SPILL,
0771 MARINE ORGANISMS, ECOSYSTEMS, CRUDE OIL, BIOLOGICAL EFFECTS, ALASKA, SEDIMENTS,
0781 MARINE ORGANISMS, CHESAPEAKE BAY, BIOLOGICAL EFFECTS, OIL SPILLS, MARSHES, MOLLUSKS,
 *MARSH GRASS,
0763 MARINE ORGANISMS, DESIGN-ENGINEERING, CONTAMINATION, CHRONIC EFFECTS, ACUTE EFFECTS,
 *CONTINUOUS FLOW BIOASSAY SYSTEM,
0764 MARINE ORGANISMS, HYDROCARBONS, ECOSYSTEMS, CRUDE OIL, TOXICITY, PETROLEUM PRODUCTS,
0783 MARINE ORGANISMS, INTERTIDAL ZONE, HYDROCARBONS, BIOLOGICAL EFFECTS, BERMUDA, TAR,
0784 MARINE ORGANISMS, CRUDE OIL, CHRONIC EFFECTS, OFFSHORE DRILLING, OFFSHORE PRODUCTION,
 PLATFORMS,
0797 MARINE ORGANISMS, CONTAMINATION, COASTS, BIOLOGICAL EFFECTS, OIL SPILLS, TROPICAL
 REGIONS, PUERTO RICO, *MANGROVES, *TURTLE GRASS,

0798 MARINE ORGANISMS, AROMATIC HYDROCARBONS, TOXICITY, PETROLEUM PRODUCTS, *SUBLETHAL EFFECTS, [illegible], GROWTH.
0799 MARINE ORGANISMS, AROMATIC HYDROCARBONS, SEAWATER, UPTAKE, RELEASE.
0801 MARINE ORGANISMS, HYDROCARBONS, PAH, METABOLISM, *BENZO(A)PYRENE, *MICROSOMAL MIXED-FUNCTION OXIDASES.
0803 MARINE ORGANISMS, INVERTEBRATES, INTERTIDAL ZONE, FUEL OIL, FISH, CRUDE OIL, ALASKA, TOXICITY.
0806 MARINE ORGANISMS, HYDROCARBONS, FISH, DESIGN-ENGINEERING, CRUDE OIL, CHRONIC EFFECTS, *FLOW-THROUGH SYSTEM.
0807 MARINE ORGANISMS, FUEL OIL, ESTUARIES, DELAWARE, TOXICITY, ULTRA-VIOLET RADIATION.
0811 MARINE ORGANISMS, CRUDE OIL, CHRONIC EFFECTS, NATURAL SEEPAGE, MOLLUSKS, SANTA BARBARA CHANNEL.
0813 MARINE ORGANISMS, INTERTIDAL ZONE, CRUDE OIL, BIOLOGICAL EFFECTS.
0814 MARINE ORGANISMS, INTERTIDAL ZONE, FUEL OIL, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, DISPERSANTS, *SPECIES DIVERSITY.
0818 MARINE ORGANISMS, OIL SPILLS, TANKERS, TOXICITY, *PHYTOPLANKTON.
0820 MARINE ORGANISMS, JAPAN, ENVIRONMENTAL EFFECTS, DEVELOPMENT, CONTAMINATION, PROJECTIONS.
0832 MARINE ORGANISMS, FATE, ESTUARIES, ENVIRONMENTAL EFFECTS, CONTAMINATION, BIOLOGICAL EFFECTS, BIBLIOGRAPHIES, OIL SPILLS, OCEANS.
0835 MARINE ORGANISMS, BIOLOGICAL EFFECTS, ATLANTIC OCEAN, OIL SPILLS, OFFSHORE DEVELOPMENT, OCS.
0836 MARINE ORGANISMS, BIOLOGICAL EFFECTS, PLATFORMS, OFFSHORE DRILLING, SANTA BARBARA CHANNEL.
0837 MARINE ORGANISMS, FISHERIES, ENVIRONMENTAL EFFECTS, OIL SPILLS, OFFSHORE DRILLING, GEORGES BANK.
0863 MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, CONTAMINATION, TOXICITY, OFFSHORE PRODUCTION, PRODUCED WATERS.
0871 MARINE ORGANISMS, LOUISIANA, HYDROCARBONS, ENVIRONMENTAL EFFECTS, OFFSHORE PRODUCTION, OIL INDUSTRY, SEDIMENTS.
0877 MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, BERING SEA, BENTHOS, BEAUFORT SEA, ALASKA, OFFSHORE DEVELOPMENT, OCS, *BASELINE STUDIES.
0880 MARINE ORGANISMS, HYDROCARBONS, ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, BIODEGRADATION, ALASKA, OFFSHORE DEVELOPMENT, OCS.
0891 MARINE ORGANISMS, HYDROCARBONS, FATE, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, PUGET SOUND, [illegible], TOXICITY, OCS.
0901 MARINE ORGANISMS, EXPLORATION, ENVIRONMENTAL EFFECTS, ARCTIC, PRODUCTION, PLANTS, WILDLIFE, OIL SPILLS.
0921 MARINE ORGANISMS, HYDROCARBONS, BIODEGRADATION, BENTHOS, METABOLISM, SEDIMENTS, MICROORGANISMS.
0922 MARINE ORGANISMS, FATE, BIOLOGICAL EFFECTS, API, OIL SPILLS.
0926 MARINE ORGANISMS, MAGELLAN STRAIT OF, FATE, ESTUARIES, ENVIRONMENTAL EFFECTS, BEACHES, METULA SPILL, TANKERS.
0971 MARINE ORGANISMS, FATE, CONTAMINATION, API, TOXICITY, OIL SPILLS.
0989 MARINE ORGANISMS, ENVIRONMENTAL DETERIORATION, ECONOMICS, COMPENSATION, OIL SPILLS, WILDLIFE, *LEGAL ASPECTS.
0179 MARSHES, MARINE ORGANISMS, ENVIRONMENTAL EFFECTS, CHESAPEAKE BAY, BEACHES, OIL SPILLS.
0617 MARSHES, DETECTION, CONTAMINATION, REMOTE SENSING, OIL SPILLS, *REMOTE [illegible] [illegible].
0658 MARSHES, MANUALS, CLEANUP, BIOLOGICAL EFFECTS, OIL SPILLS.
0732 MARSHES, ENVIRONMENTAL PROTECTION, OIL SPILLS, POLLUTION PREVENTION, SHORELINES.
0746 MARSHES, ESTUARIES, OIL SPILLS, POLLUTION CONTROL, MOVEMENT, *GRASS-CUTTING, *HACKENSACK ESTUARY.
0767 MARSHES, MARINE ORGANISMS, INTERTIDAL ZONE, FLORIDA COAST, CORAL REEFS, BIOLOGICAL EFFECTS, OIL SPILLS, TROPICAL REGIONS.
0101 MARSHES, MARINE ORGANISMS, CHESAPEAKE BAY, BIOLOGICAL EFFECTS, OIL SPILLS, MOLLUSKS, *MARSH GRASS.
0081 MEDITERRANEAN SEA, CLEANUP, SKIMMERS, OIL SPILLS, MONITORING.
0880 MEDITERRANEAN SEA, HYDROCARBONS, SEDIMENTS, SAMPLING, SURFACE MICROLAYER COMPOSITION.
0809 METABOLISM, MARINE ORGANISMS, INTERTIDAL ZONE, HYDROCARBONS, CHROMATOGRAPHY, CHEMICAL ANALYSIS, MONITORING, *BIOGENIC HYDROCARBONS.
0760 METABOLISM, FUEL OIL, CRUDE OIL, BENTHOS, ALGAE, TOXICITY, WASTE OIL.
0770 METABOLISM, HYDROCARBONS, FOOD WEB, CHEMICAL ANALYSIS, BIRDS, BIOLOGICAL EFFECTS, EGGS.
0774 METABOLISM, CRUDE OIL, MOLLUSKS, *CLAMS, *MYA ARENARIA.
0779 METABOLISM, MARINE MAMMALS, CRUDE OIL, BIOLOGICAL EFFECTS, *SEALS.
0801 METABOLISM, MARINE ORGANISMS, HYDROCARBONS, PAH, *BENZO(A)PYRENE, *MICROSOMAL MIXED-FUNCTION OXIDASES.
0802 METABOLISM, FUEL OIL, CONTAMINATION, BIOLOGICAL EFFECTS, SEDIMENTS, POLYCHAETES, FEEDING ACTIVITY, *ARENICOLA MARINA.
0804 METABOLISM, HYDROCARBONS, UPTAKE, RELEASE, POLYCHAETES, SEDIMENTS, SEAWATER, *NEANTHES ARENACEODENTATA.
0805 METABOLISM, HYDROCARBONS, FUEL OIL, BIOLOGICAL EFFECTS, POLYCHAETES, UPTAKE, *NEANTHES ARENACEODENTATA.
0803 METABOLISM, FRESHWATER, CRUDE OIL, ALGAE, *NAPHTHALENE, TOXICITY, *CHLAMYDOMONAS ANGULOSA.

[illegible] METABOLISM, HYDROCARBONS, FISH, CONTAMINATION, BIOLOGICAL EFFECTS,

[illegible] METABOLISM, [illegible]

[illegible] METABOLISM, [illegible] BIODEGRADATION, BACTERIA, [illegible] COMPOUNDS,

[illegible] METABOLISM, MARINE ORGANISMS, HYDROCARBONS, BIODEGRADATION, BENTHOS, SEDIMENTS, MICROORGANISMS,

[illegible] METABOLISM, HYDROCARBONS, BIODEGRADATION, MICROORGANISMS,

[illegible] METABOLISM, BIODEGRADATION, PETROCHEMICALS, MICROORGANISMS,

[illegible] METABOLISM, HYDROCARBONS, BIODEGRADATION, MICROORGANISMS, *MUTAGENS,

[illegible] METABOLISM, HYDROCARBONS, FUEL OIL, FATE, CHESAPEAKE BAY, SEDIMENTS, WEATHERING, MOLLUSKS,

0537 METULA SPILL, ENVIRONMENTAL PROTECTION, OIL SPILLS, TANKERS, OFFSHORE DRILLING, POLLUTION CONTROL,

0565 METULA SPILL, MARINE ORGANISMS, MAGELLAN/STRAIT OF, FATE, ESTUARIES, ENVIRONMENTAL EFFECTS, [illegible] TANKERS,

[illegible] MEXICO/GULF OF, ENVIRONMENTAL EFFECTS, OIL SPILLS, OCS, [illegible] REPORT,

[illegible] MEXICO/GULF OF, HYDROCARBONS, DISTRIBUTION, CHEMICAL ANALYSIS, SAMPLING, SEDIMENTS, SOURCES,

0918 MEXICO/GULF OF, HYDROCARBONS, DISTRIBUTION, CHEMICAL ANALYSIS, ZOOPLANKTON, SOURCES, *BIOGENIC HYDROCARBONS,

0919 MEXICO/GULF OF, HYDROCARBONS, CHROMATOGRAPHY, ALGAE, SEDIMENTS, MISSISSIPPI RIVER, SAMPLING,

0642 MEXICO/GULF OF, LEGISLATION, FLORIDA, ENVIRONMENTAL EFFECTS, PORTS, OIL TRANSFER, SOCIO-ECONOMIC EFFECTS, *DEEPWATER PORTS,

0654 MEXICO/GULF OF, ENVIRONMENTAL EFFECTS, COASTS, OFFSHORE DEVELOPMENT, OCS, SOCIO-ECONOMIC EFFECTS,

[illegible] MEXICO/GULF OF, ENVIRONMENTAL PROTECTION, CALIFORNIA/SOUTHERN, ALASKA, OFFSHORE DRILLING, OFFSHORE DEVELOPMENT, REGULATIONS,

[illegible] MEXICO/GULF OF, MARINE ORGANISMS, HYDROCARBONS, FATE, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, [illegible] TOXICITY, [illegible]

[illegible] MEXICO/GULF OF, CALIFORNIA COAST, BLOWOUT PREVENTION, ATLANTIC COAST, OFFSHORE DRILLING, OCS, TANKERS, OIL TRANSPORT, OIL SPILLS,

[illegible] MICROORGANISMS, HYDROCARBONS, DISTRIBUTION, BACTERIA, SAMPLING, TAR, SEDIMENTS, OFFSHORE DEVELOPMENT, NORTH SEA,

[illegible] MICROORGANISMS, CANADA, BIOLOGICAL EFFECTS, OIL SPILLS, VEGETATION, SOIL,

[illegible] MICROORGANISMS, ESTUARIES, DISTRIBUTION, BACTERIA, OIL SPILLS,

[illegible] MICROORGANISMS, HYDROCARBONS, ENVIRONMENTAL EFFECTS, DISTRIBUTION, CHEMICAL ANALYSIS, ALASKA, OFFSHORE DEVELOPMENT, OCS, *BASELINE STUDIES,

[illegible] MICROORGANISMS, CRUDE OIL, BIODEGRADATION, ARCTIC, ALASKA,

[illegible] MICROORGANISMS, BIODEGRADATION, AFRICA/SOUTH, OIL SPILLS, WASTE OIL, PATENT,

[illegible] MICROORGANISMS, HYDROCARBONS, BIODEGRADATION, SOILS, OXIDATION, *OXYGEN UPTAKE RATE,

[illegible] MICROORGANISMS, HYDROCARBONS, FRESHWATER ECOSYSTEMS, BIODEGRADATION,

[illegible] MICROORGANISMS, CRUDE OIL, BIODEGRADATION, OCEANS, *NUTRIENT REQUIREMENTS,

[illegible] MICROORGANISMS, CARCINOGENS, BIODEGRADATION, AROMATIC HYDROCARBONS, PAH,

[illegible] MICROORGANISMS, CARCINOGENS, BIODEGRADATION, BACTERIA, PAH,

[illegible] MICROORGANISMS, FUELS, BIODEGRADATION, *SUPERSONIC AIRCRAFT FUEL,

[illegible] MICROORGANISMS, HYDROCARBONS, BIODEGRADATION,

[illegible] MICROORGANISMS, BIODEGRADATION, BACTERIA, ATLANTIC OCEAN, OXIDATION, POLLUTION CONTROL,

[illegible] MICROORGANISMS, METABOLISM, MARINE ORGANISMS, HYDROCARBONS, BIODEGRADATION, BENTHOS, SEDIMENTS,

[illegible] MICROORGANISMS, HYDROCARBONS, BIODEGRADATION, SEAWATER,

[illegible] MICROORGANISMS, DECOMPOSITION, BIODEGRADATION, OIL SPILLS, SOIL, MODELS, *NUTRIENT DEMAND,

[illegible] MICROORGANISMS, BIODEGRADATION, BARENTS SEA, BALTIC SEA, ATLANTIC OCEAN, PETROLEUM PRODUCTS,

[illegible] MICROORGANISMS, METABOLISM, HYDROCARBONS, BIODEGRADATION,

[illegible] MICROORGANISMS, BIODEGRADATION, OIL SPILLS,

[illegible] MICROORGANISMS, FUEL OIL, FRESHWATER, BIODEGRADATION, *CONTINUOUS CULTURE,

[illegible] MICROORGANISMS, ENVIRONMENTAL EFFECTS, CRUDE OIL, BIODEGRADATION, PETROLEUM PRODUCTS, OXIDATION,

[illegible] MICROORGANISMS, HYDROCARBONS, GROUNDWATER, CRUDE OIL, BIODEGRADATION, PETROLEUM PRODUCTS, USSR,

[illegible] MICROORGANISMS, METABOLISM, BIODEGRADATION, PETROCHEMICALS,

[illegible] MICROORGANISMS, ESTUARIES, CRUDE OIL, CHESAPEAKE BAY, BIODEGRADATION,

[illegible] MICROORGANISMS, METABOLISM, HYDROCARBONS, BIODEGRADATION, *MUTAGENS,

[illegible] MISSISSIPPI RIVER, MEXICO/GULF OF, HYDROCARBONS, CHROMATOGRAPHY, ALGAE, SEDIMENTS, SAMPLING,

[illegible] MODELS, GREAT LAKES , COASTS, OIL SPILLS, US STATISTICAL ANALYSIS, *DISCRIMINANT ANALYSIS,

[illegible] MODELS, ESTUARIES, DRIFT, DELAWARE BAY, REMOTE SENSING, *FRONTS, OIL SLICKS, SPREADING,

[illegible] MODELS, COST ANALYSIS, CLEANUP, OIL SPILLS, RECOVERY,

[illegible] MODELS, ECONOMIC EFFECTS, POLLUTION CONTROL, OIL SPILLS, *COSTS, *POLLUTER RESPONSE,

[illegible] MODELS, FATE, COST ANALYSIS, CLEANUP, OIL SPILLS, MOVEMENT, STATISTICAL ANALYSIS,

[illegible] MODELS, FATE, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, OIL SPILLS, TANKERS, WILDLIFE, *WORLD WAR II SPILLS,

0838 MODELS, MICROORGANISMS, DECOMPOSITION, BIODEGRADATION, OIL SPILLS, SOIL, *NUTRIENT [illegible]
[illegible] MODELS, [illegible], BIODEGRADATION, SOIL, MONITORING,
[illegible] MODELS, [illegible]
[illegible] MODELS, [illegible], CONTAMINATION, OIL SPILLS,
[illegible] MODELS, [illegible]
[illegible] MODELS, [illegible] OIL LOSSES,
[illegible] MODELS, [illegible] *STORM MODELING,
[illegible] MODELS, [illegible]
[illegible] MODELS, [illegible], FATE, EMULSIFICATION, DECOMPOSITION, ADSORPTION, OIL SPILLS, SPREADING, SOLUTION
0370 MODELS, HYDROCARBONS, FATE, EVAPORATION, BIODEGRADATION, OIL SPILLS, OCEANS, SPREADING,
[illegible] MODELS, DELAWARE, [illegible] OIL SPILLS, MOVEMENT, OFFSHORE DRILLING, PORTS, NEW JERSEY,
[illegible] MODELS, FATE, [illegible] DELAWARE BAY, OIL SPILLS, SPREADING,
0587 MOLLUSKS, CARCINOGENS, CALIFORNIA/SOUTHERN, MONITORING, PAH, *MUSSELS, *BENZO(A)PYRENE
0588 MOLLUSKS, CLEANUP, OIL SPILLS, SEAWATER, OXIDATION, *WATER PURIFICATION, *MUSSELS, *MYTILUS EDULIS
0682 MOLLUSKS, BALLAST, WASTEWATER TREATMENT, TANKERS, *MYTILUS GALLOPROVINCIALIS
0754 MOLLUSKS, FUEL OIL, CRUSTACEANS, BIOLOGICAL EFFECTS, BEHAVIOR, *GROWTH, *SUBLETHAL EFFECTS, [illegible]
0764 MOLLUSKS, [illegible], CONTAMINATION, AROMATIC HYDROCARBONS, ACCUMULATION, WASTEWATERS, [illegible]
0773 MOLLUSKS, [illegible] *ARTEMIA,
0778 MOLLUSKS, HYDROCARBONS, [illegible], PLATFORMS, SEDIMENTS, TEXAS, *TRINITY BAY, [illegible]
0781 MOLLUSKS, [illegible], MARINE ORGANISMS, CHESAPEAKE BAY, BIOLOGICAL EFFECTS, OIL SPILLS, [illegible]
0789 MOLLUSKS, AROMATIC HYDROCARBONS, UPTAKE, RELEASE, *MODIOLUS DEMISSUS, *CRASSOSTREA VIRGINICA, [illegible] SULFUR COMPOUNDS
2795 MOLLUSKS, HYDROCARBONS, CONTAMINATION, BIOLOGICAL EFFECTS, *SCALLOPS, *PECTEN [illegible]
0808 MOLLUSKS, CRUDE OIL, CHEMICAL ANALYSIS, BIOLOGICAL EFFECTS, BEHAVIOR, SEDIMENTS, [illegible] *MACOMA BALTHICA
0811 MOLLUSKS, MARINE ORGANISMS, CRUDE OIL, CHRONIC EFFECTS, NATURAL SEEPAGE, SANTA BARBARA CHANNEL,
0818 MOLLUSKS, ESTUARIES, ECONOMIC EFFECTS, CARCINOGENS, PAH, OREGON, *BENZO(A)PYRENE,
0878 MOLLUSKS, HABITAT, FISH, ENVIRONMENTAL EFFECTS, ALASKA, OFFSHORE DEVELOPMENT, OCS, [illegible]
0950 MOLLUSKS, METABOLISM, HYDROCARBONS, FUEL OIL, FATE, CHEDABUCTO BAY, SEDIMENTS, WEATHERING
0378 MONITORING, BIOLOGICAL EFFECTS, OIL SPILLS,
0482 MONITORING, ATLANTIC OCEAN, ARGO MERCHANT SPILL, OIL SPILLS, REMOTE SENSING, SPREADING, MOVEMENT
0381 MONITORING, DETECTION, DESIGN-ENGINEERING, SHIPS, USCG, *OIL-IN-WATER,
[illegible] MONITORING, OIL SLICKS, [illegible]
[illegible] MONITORING, ABSORPTION, OIL SLICKS, [illegible] *LASER BEAM,
[illegible] MONITORING, [illegible], CHROMATOGRAPHY, CHEMICAL ANALYSIS, CARCINOGENS, PAH, SAMPLING, [illegible] COASTAL WATERS
0587 MONITORING, MOLLUSKS, CARCINOGENS, CALIFORNIA/SOUTHERN, PAH, *MUSSELS, *BENZO(A)PYRENE
0588 MONITORING, DETECTION, ANALYTICAL TECHNIQUES, WASTEWATERS, *LIGHT SCATTERING, *PARTICULATES, *OIL-IN-WATER,
[illegible] MONITORING, DESIGN-ENGINEERING, BALLAST, OIL DISCHARGES, TANKERS,
[illegible] MONITORING, MARINE ORGANISMS, HYDROCARBONS, CONTAMINANTS, ANALYTICAL TECHNIQUES, OCEANS, TAR, SAMPLING,
[illegible] MONITORING, WASTEWATERS, OIL-WATER SEPARATION, PATENT,
[illegible] MONITORING, DETECTION, CHEMICAL ANALYSIS, WASTEWATERS,
[illegible] MONITORING, HYDROCARBONS, DESIGN-ENGINEERING, *OIL-IN-WATER, *FLUORESCENCE,
[illegible] MONITORING, CONTAMINATION, [illegible], BALLAST, SHIPS
[illegible] MONITORING, DISTRIBUTION, ATLANTIC OCEAN, TAR, SAMPLING,
[illegible] MONITORING, LEAKAGE, DETECTION, DESIGN-ENGINEERING, OIL TANKS, PATENT,
[illegible] MONITORING, HYDROCARBONS, DISTRIBUTION, BEAUFORT SEA, WATER QUALITY,
[illegible] MONITORING, HYDROCARBONS, DISTRIBUTION, OCEANS, SURVEILLANCE,
[illegible] MONITORING, DETECTION, CRUDE OIL, CHROMATOGRAPHY, SEDIMENTS, *OIL-IN-WATER, BIOLOGICAL MATERIALS
0500 MONITORING, U.S. COASTS, BLM, OCS, OIL-GAS LEASING, REGULATIONS, *ENVIRONMENTAL STUDIES PROJECT
0501 MONITORING, HYDROCARBONS, GOVERNMENT AGENCIES, EPA, OIL SPILLS, POLLUTION CONTROL, SURVEILLANCE, USGS, USCG, NOAA
0502 MONITORING, LEAKAGE, DETECTION, DESIGN-ENGINEERING, PIPELINES, OIL SLICKS, WASTEWATERS, PATENT
0503 MONITORING, HYDROCARBONS, DETECTION, DESIGN-ENGINEERING, PATENT,
0504 MONITORING, DESIGN-ENGINEERING, OIL SLICKS, [illegible] OIL SENSOR,
0505 MONITORING, HYDROCARBONS, CHEMICAL ANALYSIS, CALIFORNIA/SOUTHERN, SEDIMENTS, SOURCE IDENTIFICATION

[illegible] MONITORING, [illegible], OIL DISCHARGE, [illegible], [illegible], SOIL CONTENT,
[illegible] MONITORING, [illegible]
[illegible] MONITORING, [illegible], HYDROCARBONS,
[illegible]
[illegible] MONITORING, [illegible]
[illegible] MONITORING, [illegible]
[illegible] MONITORING, [illegible], ENVIRONMENTAL EFFECTS, ANIMALS, OIL TRANSPORT,
PIPELINES, PLANTS
0730 MONITORING, POLLUTION CONTROL, REFINERIES, *NATURAL GAS PLANTS, WASTEWATERS, SOLID
WASTES
[illegible] MONITORING, [illegible], ENVIRONMENTAL PROTECTION, [illegible], OFFSHORE PRODUCTION
[illegible] MONITORING, [illegible], POLLUTION PREVENTION, OIL [illegible], WASTE OIL TREATMENT,
[illegible]
[illegible] MONITORING, FUEL OIL, [illegible], BIOLOGICAL EFFECTS, [illegible]
[illegible] MONITORING, [illegible], ENVIRONMENTAL EFFECTS, [illegible], ATLANTIC OCEAN, OFFSHORE DRILLING,
[illegible]
[illegible] MONITORING, INFORMATION SYSTEMS, ENVIRONMENTAL EFFECTS, CONTAMINANTS, BIOLOGICAL
EFFECTS, ALASKA, OFFSHORE DEVELOPMENT, [illegible]
[illegible] MONITORING, [illegible], HYDROCARBONS, BIODEGRADATION, SOIL,
[illegible] MONITORING, FATE, CRUDE OIL, BIODEGRADATION, BACTERIA, SAMPLING,
[illegible] MONITORING, FATE, OIL SPILLS, MOVEMENT, SAMPLING, OCEANS, NOAA,
[illegible] MOVEMENT, JAPAN, DISPERSANTS, CRUDE OIL, CLEANUP, BEACHES, OIL SPILLS, TANKERS,
PREDICTION
[illegible] MOVEMENT, MONITORING, ATLANTIC OCEAN, ARGO MERCHANT SPILL, OIL SPILLS, REMOTE SENSING,
PREDICTION
[illegible] MOVEMENT, BARRIERS, ESTUARIES, OIL SPILLS, POLLUTION CONTROL, *GRASS-CUTTING,
[illegible]
[illegible] MOVEMENT, MODELS, FATE, COST ANALYSIS, CLEANUP, OIL SPILLS, STATISTICAL ANALYSIS
[illegible] MOVEMENT, [illegible], ENVIRONMENTAL PROTECTION, CONTAMINANTS, ATLANTIC COAST, OFFSHORE
DRILLING, [illegible]
[illegible] MOVEMENT, [illegible], ENVIRONMENTAL EFFECTS, CANADA, BEHAVIOR, ARCTIC, OIL SPILLS, OFFSHORE
DRILLING, BLOWOUTS, [illegible]
[illegible] MOVEMENT, MONITORING, FATE, OIL SPILLS, SAMPLING, OCEANS, NOAA,
[illegible] MOVEMENT, MODELS, [illegible], ALASKA/GULF OF, OIL SPILLS, [illegible]
[illegible] MOVEMENT, HYDROCARBONS, [illegible], CONTAMINATION, POLLUTION CONTROL,
[illegible] MOVEMENT, MODELS, DELAWARE, COASTS, OIL SPILLS, OFFSHORE DRILLING, PORTS, NEW JERSEY,
[illegible] MOVEMENT, FATE, [illegible] BAY, BIOLOGICAL EFFECTS, BENTHOS, BEACHES, OIL SPILLS,
[illegible]
[illegible] NATURAL SEEPAGE, HYDROCARBONS, CHEMICAL ANALYSIS, ALASKA/GULF OF,
[illegible] NATURAL SEEPAGE, CRUDE OIL, STATISTICAL ANALYSIS, *OIL INPUT, SOURCES, OCEANS, WASTE
OIL, OIL DISCHARGE, TANKERS
0569 NATURAL SEEPAGE, HYDROCARBONS, SOURCES, OCEANS, *BIOGENIC HYDROCARBONS, *INPUT
ESTIMATES
0611 NATURAL SEEPAGE, DETECTION, REMOTE SENSING, OIL SLICKS, SURVEILLANCE, SANTA BARBARA
CHANNEL
0619 NATURAL SEEPAGE, DETECTION, REMOTE SENSING, OIL SLICKS, PLATFORMS, SANTA BARBARA
CHANNEL, [illegible]
[illegible] NATURAL SEEPAGE, MOLLUSKS, MARINE ORGANISMS, CRUDE OIL, CHRONIC EFFECTS, SANTA BARBARA
CHANNEL
[illegible] NEW JERSEY, MOVEMENT, MODELS, DELAWARE, COASTS, OIL SPILLS, OFFSHORE DRILLING, PORTS,
[illegible] NEW [illegible], INVERTEBRATES, FUEL OIL, FISH, BIOLOGICAL EFFECTS, OIL SPILLS,
[illegible]
[illegible] NEW YORK, HYDROCARBONS, HARBORS, DISTRIBUTION, CONTAMINATION, SAMPLING, *EXTRACTABLE
ORGANICS
[illegible] NEW YORK, PLANNING, COASTS, OFFSHORE DRILLING, OIL SPILLS,
[illegible] NEW YORK, MODELS, DAMAGES, SAFETY, OIL SPILLS, [illegible]
[illegible] NOAA, MEXICO/GULF OF, MARINE ORGANISMS, HYDROCARBONS, FATE, ENVIRONMENTAL EFFECTS,
OFFSHORE DEVELOPMENT, [illegible]
[illegible] NOAA, MOVEMENT, MONITORING, FATE, OIL SPILLS, SAMPLING, OCEANS,
[illegible] NORTH SEA, LEAKAGE, CONTINGENCY PLANNING, OFFSHORE DEVELOPMENT, OIL SPILLS, *NATO,
[illegible] NORTH SEA, OIL SPILLS, OFFSHORE PRODUCTION, PLATFORMS, [illegible], CORROSION,
[illegible] NORTH SEA, MICROORGANISMS, HYDROCARBONS, DISTRIBUTION, BACTERIA, SAMPLING, TAR,
SEDIMENTS, OFFSHORE DEVELOPMENT
0710 NORTH SEA, CONTINGENCY PLANNING, CLEANUP, OIL SPILLS, PERSONNEL TRAINING, OIL FIELDS,
*BP FORTIES OILFIELD
[illegible] NORTH SEA, CONTAINMENT, BLOWOUT PREVENTION, OFFSHORE DRILLING, OIL SPILLS,
[illegible] NORWAY, LIABILITY, FRANCE, EUROPE, DENMARK, OFFSHORE DEVELOPMENT, UK, *POLLUTION
DAMAGE
0568 OCEANS, NATURAL SEEPAGE, CRUDE OIL, STATISTICAL ANALYSIS, *OIL INPUT, SOURCES, WASTE
OIL, OIL DISCHARGE, TANKERS
0569 OCEANS, NATURAL SEEPAGE, HYDROCARBONS, SOURCES, *BIOGENIC HYDROCARBONS, *INPUT
ESTIMATES
[illegible] OCEANS, MONITORING, MARINE ORGANISMS, HYDROCARBONS, CONTAMINANTS, ANALYTICAL

TECHNIQUES, TAR, SAMPLING.
[illegible] OCEANS; MONITORING, HYDROCARBONS, DISTRIBUTION, SURVEILLANCE,
[illegible] OCEANS; [illegible]
[illegible] OCEANS; [illegible], HYDROCARBONS, FOOD WEB, DISTRIBUTION, OIL TRANSFER,
[illegible]
[illegible] OCEANS; ENVIRONMENTAL EFFECTS, POLLUTION PREVENTION, STORAGE, OIL SPILLS,
[illegible] OCEANS; [illegible], ENVIRONMENTAL EFFECTS, CLEANUP, POLLUTION CONTROL, OIL SPILLS,
[illegible] OCEANS; [illegible]
[illegible] OCEANS; MARINE ORGANISMS, FATE, ESTUARIES, ENVIRONMENTAL EFFECTS, CONTAMINATION,
BIOLOGICAL EFFECTS, [illegible], OIL SPILLS,
[illegible] OCEANS; [illegible], BIODEGRADATION, NUTRIENT REQUIREMENTS,
[illegible] OCEANS; [illegible], MONITORING, FATE, OIL SPILLS, SAMPLING,
[illegible] OCEANS; MODELS, [illegible], EVAPORATION, BIODEGRADATION, OIL SPILLS, SPREADING,
[illegible] OCEANS; LEGISLATION, INTERNATIONAL AGREEMENTS, BIBLIOGRAPHIES, OS, SHIPS, OFFSHORE
DRILLING, POLLUTION PREVENTION, OIL SPILLS,
[illegible] OCS; OIL SPILLS, ENVIRONMENTAL EFFECTS, MEXICO/GULF OF, IXTOC REPORT,
[illegible] OCS; PIPELINES, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, ECONOMICS, ALASKA,
TRANS-ALASKA PIPELINE,
0800 OCS, MONITORING, COASTS, EIS, OIL-GAS LEASING, REGULATIONS, BLM, ENVIRONMENTAL
STUDIES PROJECT,
0835 OCS, OIL SPILLS, OFFSHORE DEVELOPMENT, BIOLOGICAL EFFECTS, MARINE ORGANISMS, ATLANTIC
OCEAN,
0841 OCS; OFFSHORE DEVELOPMENT, SOCIO-ECONOMIC EFFECTS, ALASKA,
0846 OCS; OFFSHORE DRILLING, ATLANTIC COAST, ENVIRONMENTAL PROTECTION, MOVEMENT,
CONTAMINANTS, [illegible] U.S., NASA,
0851 OCS, OFFSHORE DEVELOPMENT, EPA, ENVIRONMENTAL MANAGEMENT, OIL SPILLS, WATER QUALITY,
ESTUARIES, COASTS,
0855 OCS, OFFSHORE DEVELOPMENT, COASTS, ENVIRONMENTAL EFFECTS, SOCIO-ECONOMIC EFFECTS,
MEXICO/GULF OF,
0858 OCS, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, DELAWARE, ATLANTIC
COAST,
0859 OCS, OFFSHORE DEVELOPMENT, CALIFORNIA/SOUTHERN, ENVIRONMENTAL EFFECTS, GEOLOGIC
HAZARDS,
0865 OCS, OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, MONITORING, GUIDELINES, ATLANTIC OCEAN,
BLM,
0866 OCS; OFFSHORE DEVELOPMENT; ENVIRONMENTAL EFFECTS,
0868 OCS; OFFSHORE DEVELOPMENT; HYDROCARBONS; ENVIRONMENTAL DETERIORATION, HEALTH HAZARDS,
ATLANTIC OCEAN,
0869 OCS; OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, PLATFORMS; ATLANTIC OCEAN; BLM,
0871 OCS; ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, ALASKA; MARINE MAMMALS; BASELINE
STUDIES,
0873 OCS; ENVIRONMENTAL EFFECTS; OFFSHORE DEVELOPMENT; ALASKA; BIRDS; BASELINE STUDIES;
0875 OCS; ENVIRONMENTAL EFFECTS; OFFSHORE DEVELOPMENT; ALASKA; BIRDS; BASELINE STUDIES;
0876 OCS; ENVIRONMENTAL EFFECTS; OFFSHORE DEVELOPMENT; ALASKA; BIRDS, BASELINE STUDIES,
0877 OCS; ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, ALASKA, BENTHOS, MARINE ORGANISMS,
BEAUFORT SEA, BERING SEA, BASELINE STUDIES,
0878 OCS, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, ALASKA, FISH, MOLLUSKS, HABITAT,
BASELINE STUDIES,
0879 OCS, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, ALASKA, PLANKTON, BENTHOS,
FISHERIES, BASELINE STUDIES,
0880 OCS, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, ALASKA,
HYDROCARBONS, MARINE ORGANISMS, BIODEGRADATION,
0881 OCS, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, ALASKA, MICROORGANISMS,
HYDROCARBONS, CHEMICAL ANALYSIS, DISTRIBUTION, BASELINE STUDIES,
0882 OCS, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, ALASKA, BIODEGRADATION,
HYDROCARBONS, DISTRIBUTION, BASELINE STUDIES,
0883 OCS, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, ALASKA, BASELINE STUDIES, PHYSICAL
OCEANOGRAPHY, METEOROLOGY,
0884 OCS, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, ALASKA, BASELINE STUDIES, GEOLOGIC
HAZARDS, MARINE GEOLOGY,
0885 OCS, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, ALASKA, BASELINE STUDIES, GEOLOGIC
HAZARDS,
0886 OCS, ENVIRONMENTAL EFFECTS, OFFSHORE DEVELOPMENT, ALASKA, ICE, ARCTIC OCEAN, BASELINE
STUDIES,
0889 OCS; ATLANTIC OCEAN, EIS, GEOLOGIC FRAMEWORK,
0891 OCS; OIL SPILLS, OIL-GAS LEASING, FATE, ENVIRONMENTAL EFFECTS, ATLANTIC OCEAN, RISK
ANALYSIS,
0895 OCS; OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, OIL SPILLS, PIPELINES, FLORIDA,
0897 OCS; OFFSHORE DRILLING, BLOWOUT PREVENTION, TANKERS, OIL TRANSPORT, OIL SPILLS,
ATLANTIC COAST, CALIFORNIA COAST, MEXICO/GULF OF,
0898 OCS; OFFSHORE DEVELOPMENT, ATLANTIC OCEAN, ENVIRONMENTAL EFFECTS,
0902 OCS; OIL-GAS LEASING, OFFSHORE DEVELOPMENT, ECONOMICS, ENVIRONMENTAL PROTECTION, SUBSI,
0903 OCS; OIL-GAS LEASING, EIS, ENVIRONMENTAL PROTECTION, BLM,
0904 OCS; OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, ALASKA, BIOLOGICAL EFFECTS,
CONTAMINANTS, MONITORING, INFORMATION SYSTEMS,

[illegible] OCS, MODELS, OIL SPILLS, MOVEMENT, DRIFT, ALASKA/GULF OF, [illegible]
[illegible] OCS, [illegible] OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, POLLUTION CONTROL,
[illegible]
[illegible] OFFSHORE DEVELOPMENT, NORTH SEA, OIL SPILLS, LIABILITY, CONTINGENCY PLANNING, [illegible]
[illegible] OFFSHORE DEVELOPMENT, [illegible] ENVIRONMENTAL EFFECTS, ECONOMICS, ALASKA,
[illegible]
[illegible] OFFSHORE DEVELOPMENT, OIL SPILLS, STATISTICS, TANKERS, PIPELINES, SPILL [illegible]
[illegible] OFFSHORE DEVELOPMENT, [illegible] HYDROCARBONS, DISTRIBUTION, MICROORGANISMS, BACTERIA,
[illegible] NORTH SEA
0838 OFFSHORE DEVELOPMENT, PORTS, TANKERS, SOCIO-ECONOMIC EFFECTS, ENVIRONMENTAL EFFECTS,
DEEPWATER TERMINALS
0845 OFFSHORE DEVELOPMENT, OCS, OIL SPILLS, BIOLOGICAL EFFECTS, MARINE ORGANISMS, ATLANTIC
OCEAN
[illegible] OFFSHORE DEVELOPMENT, OCS, SOCIO-ECONOMIC EFFECTS, ALASKA
[illegible] OFFSHORE DEVELOPMENT, ECONOMIC EFFECTS, ONSHORE IMPACTS, SCOTLAND
[illegible] OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, [illegible] REGULATIONS, OIL INDUSTRY,
[illegible] OFFSHORE DEVELOPMENT, [illegible] OIL SPILLS, ENVIRONMENTAL DETERIORATION, DELAWARE,
GOVERNMENT AGENCIES, COASTAL RECREATION
0848 OFFSHORE DEVELOPMENT, LIABILITY, EUROPE, UK, FRANCE, DENMARK, NORWAY, *POLLUTION
DAMAGE
0851 OFFSHORE DEVELOPMENT, OCS, EPA, ENVIRONMENTAL MANAGEMENT, OIL SPILLS, WATER QUALITY,
ESTUARIES, COASTS
[illegible] OFFSHORE DEVELOPMENT, ECONOMICS, ENVIRONMENTAL EFFECTS,
[illegible] OFFSHORE DEVELOPMENT, OCS, COASTS, ENVIRONMENTAL EFFECTS, SOCIO-ECONOMIC EFFECTS,
MEXICO/GULF OF
0858 OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, DELAWARE, ATLANTIC
COAST
0859 OFFSHORE DEVELOPMENT, OCS, CALIFORNIA/SOUTHERN, ENVIRONMENTAL EFFECTS, *GEOLOGIC
HAZARDS
0860 OFFSHORE DEVELOPMENT, OFFSHORE DRILLING, ENVIRONMENTAL PROTECTION, REGULATIONS,
ALASKA, CALIFORNIA/SOUTHERN, MEXICO/GULF OF,
[illegible] OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS,
[illegible] OFFSHORE DEVELOPMENT, OCS, HYDROCARBONS, ENVIRONMENTAL DETERIORATION, HEALTH HAZARDS,
ATLANTIC OCEAN
[illegible] OFFSHORE DEVELOPMENT, ECONOMICS, ENVIRONMENTAL EFFECTS, OFFSHORE DRILLING,
[illegible] OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ALASKA, MARINE MAMMALS, *BASELINE
STUDIES
[illegible] OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ALASKA, BIRDS, *BASELINE STUDIES,
[illegible] OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ALASKA, BIRDS, *BASELINE STUDIES,
[illegible] OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ALASKA, BIRDS, *BASELINE STUDIES,
[illegible] OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ALASKA, BENTHOS, MARINE ORGANISMS,
BEAUFORT SEA, BERING SEA, *BASELINE STUDIES
0878 OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ALASKA, FISH, MOLLUSKS, HABITAT,
*BASELINE STUDIES
0879 OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ALASKA, PLANKTON, BENTHOS,
FISHERIES, *BASELINE STUDIES
0880 OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, BIOLOGICAL EFFECTS, ALASKA,
HYDROCARBONS, MARINE ORGANISMS, BIODEGRADATION,
0881 OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ALASKA, MICROORGANISMS,
HYDROCARBONS, CHEMICAL ANALYSIS, DISTRIBUTION, *BASELINE STUDIES,
0882 OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ALASKA, BIODEGRADATION,
HYDROCARBONS, DISTRIBUTION, *BASELINE STUDIES,
0883 OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ALASKA, *BASELINE STUDIES, PHYSICAL
OCEANOGRAPHY, METEOROLOGY
0884 OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ALASKA, *BASELINE STUDIES, *GEOLOGIC
HAZARDS, MARINE GEOLOGY
0885 OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ALASKA, *BASELINE STUDIES, *GEOLOGIC
HAZARDS
0886 OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ALASKA, ICE, ARCTIC OCEAN, *BASELINE
STUDIES
0887 OFFSHORE DEVELOPMENT, OFFSHORE EXPLORATION, SOCIO-ECONOMIC EFFECTS, ONSHORE IMPACTS,
FLORIDA
0888 OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, ONSHORE IMPACTS, SOCIO-ECONOMIC EFFECTS,
REFINERIES, PORTS, COASTS, FLORIDA, GUIDELINES
0891 OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, PUGET SOUND, MEXICO/GULF OF, FATE,
HYDROCARBONS, TOXICITY, MARINE ORGANISMS, NOAA
[illegible] OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, OIL SPILLS, PIPELINES, FLORIDA,
[illegible] OFFSHORE DEVELOPMENT, OIL SPILLS, FISHERIES, ECONOMIC EFFECTS, ATLANTIC COAST,
[illegible] OFFSHORE DEVELOPMENT, OCS, ATLANTIC OCEAN, ENVIRONMENTAL EFFECTS
[illegible] OFFSHORE DEVELOPMENT, SOCIO-ECONOMIC EFFECTS, ENVIRONMENTAL EFFECTS, ATLANTIC OCEAN,
[illegible] OFFSHORE DEVELOPMENT, OCS, OIL-GAS LEASING, ECONOMICS, ENVIRONMENTAL PROTECTION, *GULF,
[illegible] OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ALASKA, BIOLOGICAL EFFECTS,
CONTAMINANTS, MONITORING, INFORMATION SYSTEMS
[illegible] OFFSHORE DEVELOPMENT, REGULATIONS, ENVIRONMENTAL PROTECTION, ECONOMIC EFFECTS,
DELAWARE

0686 OFFSHORE DEVELOPMENT, OCS, LEGISLATION, US, ENVIRONMENTAL EFFECTS, POLLUTION CONTROL,
[illegible] DELAWARE

[illegible] OFFSHORE DRILLING, OIL SPILLS, ENVIRONMENTAL EFFECTS, ALASKA, PRUDHOE BAY,

[illegible] OFFSHORE DRILLING, OIL SPILLS, TANKERS, [illegible] SPILL, ENVIRONMENTAL PROTECTION,
POLLUTION CONTROL,

0781 OFFSHORE DRILLING, OIL SPILLS, BLOWOUT PREVENTION, ICE, DISPERSANTS, CONTAINMENT,
[illegible]

[illegible] OFFSHORE DRILLING, BLOWOUT PREVENTION, CONTAINMENT, OIL SPILLS, NORTH SEA,

[illegible] OFFSHORE DRILLING, OFFSHORE PRODUCTION, CHRONIC EFFECTS, CRUDE OIL, PLATFORMS, MARINE
ORGANISMS

0810 OFFSHORE DRILLING, PLATFORMS, BIOLOGICAL EFFECTS, MARINE ORGANISMS, SANTA BARBARA
CHANNEL

0817 OFFSHORE DRILLING, OIL SPILLS, ENVIRONMENTAL EFFECTS, FISHERIES, MARINE ORGANISMS,
[illegible]

0846 OFFSHORE DRILLING, OCS, ATLANTIC COAST, ENVIRONMENTAL PROTECTION, MOVEMENT,
CONTAMINANTS, [illegible]

0853 OFFSHORE DRILLING, OIL INDUSTRY, ENVIRONMENTAL EFFECTS, CALIFORNIA COAST, ONSHORE
IMPACTS,

0860 OFFSHORE DRILLING, OFFSHORE DEVELOPMENT, ENVIRONMENTAL PROTECTION, REGULATIONS,
ALASKA, CALIFORNIA, SOUTHERN, MEXICO/GULF OF,

[illegible] OFFSHORE DRILLING, OIL SPILLS, FISHERIES, COASTS, NEW YORK,

[illegible] OFFSHORE DRILLING, OCS, ENVIRONMENTAL EFFECTS, MONITORING, GUIDELINES, ATLANTIC OCEAN,
BLM,

[illegible] OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, OIL SPILLS,

[illegible] OFFSHORE DRILLING, OCS, ENVIRONMENTAL EFFECTS, PLATFORMS, ATLANTIC OCEAN, BLM,

[illegible] OFFSHORE DRILLING, OFFSHORE DEVELOPMENT, ECONOMIC [illegible], ENVIRONMENTAL EFFECTS,

[illegible] OFFSHORE DRILLING, ARCTIC, ENVIRONMENTAL EFFECTS, BEAUFORT SEA, CANADA,

[illegible] OFFSHORE DRILLING, OCS, BLOWOUT PREVENTION, TANKERS, OIL TRANSPORT, OIL SPILLS,
ATLANTIC COAST, CALIFORNIA COAST, MEXICO/GULF OF,

[illegible] OFFSHORE DRILLING, BLOWOUT PREVENTION, POLLUTION CONTROL, ARCTIC, BEAUFORT SEA,

[illegible] OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, EIS, SANTA BARBARA CHANNEL, AIR QUALITY
IMPACTS,

0881 OFFSHORE DRILLING, ICE, OIL SPILLS, MOVEMENT, BEHAVIOR, ENVIRONMENTAL EFFECTS, ARCTIC,
CANADA, BLOWOUTS, [illegible]

[illegible] OFFSHORE DRILLING, MODELS, OIL SPILLS, MOVEMENT, COASTS, PORTS, NEW JERSEY, DELAWARE;

[illegible] OFFSHORE DRILLING, [illegible], LEGISLATION, US, INTERNATIONAL AGREEMENTS, [illegible];
SHIPS, POLLUTION PREVENTION, OIL SPILLS

[illegible] OFFSHORE EXPLORATION, CONTAMINANTS, [illegible], DISPERSIONS, PLATFORMS, OIL TRANSPORT,

[illegible] OFFSHORE EXPLORATION, [illegible]

[illegible] OFFSHORE EXPLORATION, OFFSHORE DEVELOPMENT, SOCIO-ECONOMIC EFFECTS, ONSHORE IMPACTS,
FLORIDA

[illegible] OFFSHORE PRODUCTION, OIL SPILLS, PLATFORMS, NORTH SEA, [illegible]

[illegible] OFFSHORE PRODUCTION, [illegible], MONITORING,

[illegible] OFFSHORE PRODUCTION, OFFSHORE DRILLING, CHRONIC EFFECTS, CRUDE OIL, PLATFORMS, MARINE
ORGANISMS

0856 OFFSHORE PRODUCTION, ATLANTIC COAST, ERDA, ENVIRONMENTAL EFFECTS, OIL DISCHARGES
CHRONIC EFFECTS,

0861 OFFSHORE PRODUCTION, ENVIRONMENTAL EFFECTS, TOXICITY, CONTAMINATION, MARINE ORGANISMS,
PRODUCED WATERS,

0871 OFFSHORE PRODUCTION, OIL INDUSTRY, ENVIRONMENTAL EFFECTS, HYDROCARBONS, MARINE
ORGANISMS, SEDIMENTS, LOUISIANA

[illegible] OIL DISCHARGES, STATISTICS, US, INFORMATION SYSTEMS,

[illegible] OIL DISCHARGES, STATISTICAL ANALYSIS, OIL INPUT, SOURCES, OCEANS, CRUDE OIL, WASTE
OIL, TANKERS, NATURAL SEEPAGE

0876 OIL DISCHARGES, OIL SPILLS, PORTS, PIPELINES, REFINERIES, WATER QUALITY, PETROLEUM
FACILITIES,

[illegible] OIL DISCHARGES, US, SOURCES, USCG, [illegible]

[illegible] OIL DISCHARGES, MONITORING, BALLAST, TANKERS, DESIGN-ENGINEERING,

[illegible] OIL DISCHARGES, MONITORING, [illegible], DESIGN-ENGINEERING, USN, OIL CONTENT,

[illegible] OIL DISCHARGES, TANKERS, [illegible] TREATMENT, [illegible]

[illegible] OIL DISCHARGES, OIL TRANSFER, POLLUTION PREVENTION, STATISTICAL ANALYSIS, REGULATIONS,
USCG

[illegible] OIL DISCHARGES, POLLUTION CONTROL, LEGISLATION, EUROPE, MARINE POLLUTION,

[illegible] OIL DISCHARGES, POLLUTION PREVENTION, SHIPS, WASTE OIL TREATMENT, CLEANUP, MONITORING,
USN

0856 OIL DISCHARGES, OFFSHORE PRODUCTION, ATLANTIC COAST, ERDA, ENVIRONMENTAL EFFECTS,
CHRONIC EFFECTS

[illegible] OIL DISCHARGES, REGULATIONS, US, SHIPS, OIL TRANSFER, [illegible], USCG,

[illegible] OIL FIELDS, [illegible], CONTAMINATION, SOIL, [illegible]

[illegible] OIL FIELDS, CONTINGENCY PLANNING, OIL SPILLS, CLEANUP, PERSONNEL TRAINING, NORTH SEA,
[illegible] FORTIES OILFIELD

0808 OIL-GAS LEASING, OCS, MONITORING, COASTS, EIS, REGULATIONS, BLM, ENVIRONMENTAL
STUDIES PROJECT,

0844 OIL-GAS LEASING, OFFSHORE EXPLORATION, ECONOMIC EFFECTS, FLORIDA, ONSHORE IMPACTS, 0691 OIL-GAS LEASING, OCS, OIL SPILLS, FATE, ENVIRONMENTAL EFFECTS, ATLANTIC OCEAN, *RISK ANALYSIS

[illegible] OIL-GAS LEASING, OFFSHORE DEVELOPMENT, OCS, ECONOMICS, ENVIRONMENTAL PROTECTION, *USDI,
[illegible] OIL-GAS LEASING, [illegible]
[illegible] OIL INDUSTRY, [illegible] *CAMPECHE EXPLOSION,
[illegible] OIL INDUSTRY, [illegible]
[illegible] OIL INDUSTRY, [illegible] *ETUDAL, *REGULATORY;
[illegible] OIL INDUSTRY, PERSONNEL TRAINING, POLLUTION CONTROL, OIL SPILLS, CLEANUP, RECOVERY; REGULATIONS

0715 OIL INDUSTRY, CONTINGENCY PLANNING, OIL SPILLS, POLLUTION CONTROL, CLEANUP, PERSONNEL TRAINING, CANADA

0721 OIL INDUSTRY, CONTINGENCY PLANNING, OIL SPILLS, GASOLINE, CLEANUP, *STANDARD OIL CO, INDIANA

[illegible] OIL INDUSTRY, POLLUTION PREVENTION, REFINING, SOURCES,
[illegible] OIL INDUSTRY, POLLUTION CONTROL, REFINING, EPA
[illegible] OIL INDUSTRY, REGULATIONS, POLLUTION CONTROL, ECONOMICS, REFINING, EXPLORATION, PRODUCTION,

[illegible] OIL INDUSTRY, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, [illegible], REGULATIONS;
[illegible] OIL INDUSTRY, OFFSHORE DEVELOPMENT, OIL SPILLS, ENVIRONMENTAL DETERIORATION, DELAWARE, GOVERNMENT AGENCIES, COASTAL RECREATION

[illegible] OIL INDUSTRY, OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, CALIFORNIA COAST, ONSHORE IMPACTS

[illegible] OIL INDUSTRY, ENVIRONMENTAL EFFECTS, CONTAMINATION, POLLUTION CONTROL,
[illegible] OIL INDUSTRY, OFFSHORE PRODUCTION, ENVIRONMENTAL EFFECTS, HYDROCARBONS, MARINE ORGANISMS, SEDIMENTS, LOUISIANA

[illegible] OIL INDUSTRY, DEVELOPMENT, PIPELINES, STORAGE, SCOTLAND, SULLOM VOE TERMINAL,
[illegible] OIL INDUSTRY, LEGISLATION, US, POLLUTION CONTROL, REFINERIES, *ECONOMIC EFFECTS,
[illegible] OIL INDUSTRY, REGULATIONS, PIPELINES, WASTEWATERS, GUIDELINES, EUROPE,
[illegible] OIL INDUSTRY, GUIDELINES, PRODUCTION, EXTRACTION, WASTEWATERS, EPA, *ONSHORE POINT SOURCE CATEGORY

0997 OIL INDUSTRY, GUIDELINES, WASTEWATER TREATMENT, REFINERIES, LEGISLATION, WATER QUALITY, ECONOMICS

0597 OIL SHALE, EXTRACTION, ANALYTICAL TECHNIQUES, CHROMATOGRAPHY, CONTAMINANTS, *BY-PRODUCT WATERS

0639 OIL SHALE, DEVELOPMENT, BIOLOGICAL EFFECTS, FISH, WILDLIFE, *US FISH & WILDLIFE SERVICE

[illegible] OIL SHALE, DEVELOPMENT, EIS, COLORADO,
[illegible] OIL SHALE, PRODUCTION, EXTRACTION, ENVIRONMENTAL EFFECTS, SOLID WASTES, WASTEWATERS,
[illegible] OIL SHALE, DEVELOPMENT, EPA, ROCKY MOUNTAIN STATES,
[illegible] OIL SHALE, DEVELOPMENT, ENVIRONMENTAL EFFECTS, EXTRACTION
[illegible] OIL SHALE, DEVELOPMENT, ENVIRONMENTAL EFFECTS, *LIQUID WASTES, SOLID WASTES, LEACHING

[illegible] OIL SLICKS, MONITORING, PATENT, OIL CONTENT, SOUND SOUNDING,
[illegible] OIL SLICKS, MONITORING, SHIPS, SPECTROSCOPY, ABSORPTION, *LASER BEAM,
[illegible] OIL SLICKS, MONITORING, LEAKAGE, PIPELINES, WASTEWATERS, DETECTION, DESIGN-ENGINEERING, PATENT

[illegible] OIL SLICKS, MONITORING, SIGNAL, DESIGN-ENGINEERING, *INFRARED SCANNING OIL SENSOR,
[illegible] OIL SLICKS, REMOTE SENSING, CONTAMINANTS, COASTS, EUROPE, *SYNCHRONOUS SATELLITE,
[illegible] OIL SLICKS, REMOTE SENSING, DETECTION, SURVEILLANCE, NATURAL SEEPAGE, SANTA BARBARA CHANNEL

[illegible] OIL SLICKS, REMOTE SENSING, DETECTION, SOURCE IDENTIFICATION, *MICROWAVE RADIOMETRY,
[illegible] OIL SLICKS, REMOTE SENSING, ESTUARIES, *DELAWARE BAY, DRIFT, SPREADING, MODELS,
[illegible] OIL SLICKS, REMOTE SENSING, DETECTION, NATURAL SEEPAGE, PLATFORMS, SANTA BARBARA CHANNEL, *SIDE-LOOKING RADAR

[illegible] OIL SLICKS, REMOTE SENSING, REFINERIES, WASTEWATERS, MONITORING,
[illegible] OIL SLICKS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, SPECTROSCOPY, DETECTION,
[illegible] OIL SLICKS, PETROLEUM PRODUCTS, DETECTION, ANALYTICAL TECHNIQUES, ABSORPTION,
[illegible] OIL SLICKS, CONTAINMENT, BOOMS, DESIGN-ENGINEERING, PATENT,
[illegible] OIL SLICKS, CONTAINMENT, BOOMS, [illegible], *TIDE [illegible],
[illegible] OIL SLICKS, RECOVERY, SKIMMERS, OIL-WATER SEPARATION,
[illegible] OIL SLICKS, RECOVERY, DESIGN-ENGINEERING, PATENT, *OLEOPHILIC CONTAINER,
[illegible] OIL SLICKS, RECOVERY, SKIMMERS, DESIGN-ENGINEERING, PATENT,
[illegible] OIL SLICKS, DISPERSANTS, HYDROCARBONS, CLEANUP, BIODEGRADATION, PATENT, *NITROGEN COMPOUNDS

0694 OIL SLICKS, DISPERSANTS, HYDROCARBONS, CLEANUP, BIODEGRADATION, PATENT, *NITROGEN COMPOUNDS

0695 OIL SLICKS, DISPERSANTS, HYDROCARBONS, CLEANUP, BIODEGRADATION, PATENT, *NITROGEN COMPOUNDS

[illegible] OIL SLICKS, SKIMMERS, RECOVERY, DESIGN-ENGINEERING, PATENT,
[illegible] OIL SLICKS, CLEANUP, PETROLEUM PRODUCTS, ABSORPTION, DESIGN-ENGINEERING, PATENT,
[illegible] OIL SLICKS, SKIMMERS, RECOVERY, PATENT, DESIGN-ENGINEERING
[illegible] OIL SLICKS, CLEANUP, DISPERSANTS, DESIGN-ENGINEERING, EPA, *GARRETT,
[illegible] OIL SLICKS, SKIMMERS, RECOVERY, DESIGN-ENGINEERING, PATENT
[illegible] OIL SLICKS, BIODEGRADATION, HYDROCARBONS, BACTERIA, CLEANUP, *NUTRIENT ENRICHMENT,
[illegible] OIL SLICKS, BIODEGRADATION, HYDROCARBONS, BACTERIA, *SUPERMICROBES,

[illegible] OIL SPILLS; [illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible] OIL SPILLS; [illegible]

[illegible] OIL SPILLS; ATLANTIC COAST, [illegible], ENVIRONMENTAL EFFECTS, ARGO MERCHANT SPILL,
[illegible]
[illegible] OIL SPILLS; [illegible], BEACHES,

[illegible] OIL SPILLS; OFFSHORE DEVELOPMENT, STATISTICS, TANKERS, PIPELINES, SPILL PREDICTIONS,
[illegible] OIL SPILLS; [illegible], ENVIRONMENTAL EFFECTS, VEGETATION, PENNSYLVANIA,

[illegible] OIL SPILLS, BIOLOGICAL EFFECTS, POLLUTION PREVENTION, CLEANUP, SURVEILLANCE,

[illegible]
[illegible]
[illegible]
[illegible] OIL SPILLS; OIL DISCHARGES, PORTS, PIPELINES, REFINERIES, WATER QUALITY, *PETROLEUM FACILITIES,

[illegible] OIL SPILLS, US, STATISTICAL ANALYSIS, MODELS, GREAT LAKES , COASTS, *DISCRIMINANT ANALYSIS,

[illegible] OIL SPILLS; BIOLOGICAL EFFECTS, MONITORING,
[illegible]
[illegible] OIL SPILLS; [illegible], ATLANTIC OCEAN, ARGO MERCHANT SPILL,

[illegible] OIL SPILLS, MONITORING, HYDROCARBONS, POLLUTION CONTROL, SURVEILLANCE, GOVERNMENT AGENCIES,

[illegible] OIL SPILLS, REMOTE SENSING, [illegible], SURVEILLANCE, DESIGN-ENGINEERING, LAW ENFORCEMENT, ENVIRONMENTAL PROTECTION [illegible]

[illegible]
[illegible]
[illegible] OIL SPILLS; REMOTE SENSING; DETECTION; [illegible], CONTAMINATION, *REMOTE CONTAMINANT SENSOR,

[illegible] OIL SPILLS; REMOTE SENSING, [illegible], OPTICAL TECHNIQUES,
[illegible] OIL SPILLS; [illegible], HYDROCARBONS, WEATHERING,

[illegible] OIL SPILLS, SOURCE IDENTIFICATION, ANALYTICAL TECHNIQUES, CHROMATOGRAPHY,

[illegible] OIL SPILLS; SOURCE IDENTIFICATION; [illegible]
[illegible] OIL SPILLS; SOURCE IDENTIFICATION; [illegible]; POLLUTION PREVENTION,

[illegible] OIL SPILLS; CONTAINMENT; BOOMS, DESIGN-ENGINEERING, TIDAL CURRENTS,
[illegible]
[illegible] OIL SPILLS; CONTAINMENT; [illegible], DEFLECTORS,
[illegible] OIL SPILLS; CONTAINMENT; BOOMS; RIVERS, CONTINGENCY PLANNING, CANADA, US, *DETROIT-ST. CLAIR RIVER SYSTEM,

[illegible] OIL SPILLS; CONTAINMENT, COAGULATION, PATENT, POLYMERS,
[illegible]
[illegible]
[illegible] OIL SPILLS; [illegible], *CLEAN SWEEP,
[illegible]
[illegible]
[illegible] OIL SPILLS; [illegible], OIL SPILL FUND,
[illegible] OIL SPILLS; CLEANUP; [illegible], CONTAINMENT, DESIGN-ENGINEERING, ALASKA/GULF OF, COST ANALYSIS,

[illegible] OIL SPILLS; CLEANUP; [illegible]
[illegible] OIL SPILLS; CLEANUP; [illegible]

[illegible] OIL SPILLS; DISPERSANTS, CLEANUP, TOXICITY, BIODEGRADATION,
[illegible]
[illegible]
[illegible] OIL SPILLS; [illegible], CONTINGENCY PLANNING, COST ANALYSIS,
[illegible]
[illegible] OIL SPILLS; RECOVERY, BOOMS, SKIMMERS, OIL-WATER SEPARATION, DESIGN-ENGINEERING,

[illegible] OIL SPILLS, CLEANUP, POLLUTION CONTROL, ECONOMICS, TEXAS, *CORPUS CHRISTI,

0597 OIL SPILLS, RECOVERY, SKIMMERS, DESIGN-ENGINEERING, USCG,
[illegible] COAST GUARD,
[illegible]
[illegible] PATENT,
[illegible] DESIGN-ENGINEERING, USCG,
[illegible]
[illegible]
0613 OIL SPILLS, RECOVERY, CONTAINMENT, DESIGN-ENGINEERING, PATENT, COLLECTING BARGE,
[illegible]
[illegible] STORAGE, DISPOSAL,
0616 OIL SPILLS, RECOVERY, ABSORPTION, RIVERS, ESTUARIES, HARBORS, DESIGN-ENGINEERING, EPA,
0620 OIL SPILLS, RECOVERY, CRUDE OIL, FUEL OIL, SKIMMERS, OIL-WATER SEPARATION, CANADA,
[illegible] DESIGN-ENGINEERING,
[illegible]
[illegible] PATENT,
[illegible]
[illegible] DESIGN-ENGINEERING, USN,
[illegible] CONTAMINANTS,
[illegible]
[illegible] BIODEGRADATION, PLANTS, FERTILIZERS,
[illegible]
[illegible]
[illegible] OIL-WATER SEPARATION,
0637 OIL SPILLS, OFFSHORE DRILLING, TANKERS, METULA SPILL, ENVIRONMENTAL PROTECTION,
POLLUTION CONTROL,
0639 OIL SPILLS, PORTS, ENVIRONMENTAL EFFECTS, SOCIO-ECONOMIC EFFECTS, COASTS, DEEPWATER
PORTS,
0650 OIL SPILLS, TANKERS, OIL TRANSPORT, ECONOMICS, POLLUTION CONTROL, REGULATIONS,
STANDARDS,
0652 OIL SPILLS, TANKERS, US, REGULATIONS, INTERNATIONAL AGREEMENTS,
[illegible]
0656 OIL SPILLS, PORTS, OIL TRANSPORT, STORAGE, SOCIAL EFFECTS, ENVIRONMENTAL EFFECTS,
PACIFIC OCEAN, PALAU, SUPERPORT,
0658 OIL SPILLS, CRUDE OIL, STORAGE, ENVIRONMENTAL EFFECTS, GROUNDWATER, VEGETATION,
LOUISIANA, TEXAS, SALT DOMES,
0669 OIL SPILLS, DISPOSAL, HYDROCARBONS, BIODEGRADATION, MANUALS, SORBENTS,
0670 OIL SPILLS, CLEANUP, WASTE OIL, ABSORPTION, PATENT, METALLURGICAL FINES,
[illegible]
0710 OIL SPILLS, PERSONNEL TRAINING, POLLUTION PREVENTION, CLEANUP, CONTINGENCY PLANNING,
TEXAS,
0711 OIL SPILLS, PERSONNEL TRAINING, POLLUTION CONTROL, CONTINGENCY PLANNING, USCG,
[illegible]
0712 OIL SPILLS, PERSONNEL TRAINING, POLLUTION CONTROL, CLEANUP, CONTINGENCY PLANNING,
CANADA,
0713 OIL SPILLS, PERSONNEL TRAINING, TEXAS, SPILL CONTROL COURSE,
0714 OIL SPILLS, OIL INDUSTRY, PERSONNEL TRAINING, POLLUTION CONTROL, CLEANUP, RECOVERY,
RESTORATION,
0715 OIL SPILLS, OIL INDUSTRY, CONTINGENCY PLANNING, POLLUTION CONTROL, CLEANUP, PERSONNEL
TRAINING, CANADA,
0716 OIL SPILLS, CONTINGENCY PLANNING, US, CANADA, ST. LAWRENCE RIVER,
0717 OIL SPILLS, CONTINGENCY PLANNING, ENVIRONMENTAL EFFECTS, CLEANUP, ST. LAWRENCE RIVER,
0718 OIL SPILLS, OIL TRUCKS, CONTINGENCY PLANNING, CLEANUP, PERSONNEL TRAINING, NORTH SEA,
[illegible] OILFIELD,
0719 OIL SPILLS, CONTINGENCY PLANNING, CANADA, RESOURCE SENSITIVITY MAPS, BRITISH
COLUMBIA,
0720 OIL SPILLS, CONTINGENCY PLANNING, FATE, ENVIRONMENTAL PROTECTION, SANTA BARBARA
CHANNEL, [illegible]
0721 OIL SPILLS, OIL INDUSTRY, CONTINGENCY PLANNING, GASOLINE, CLEANUP, STANDARD OIL CO.
INDIANA,
0722 OIL SPILLS, CONTINGENCY PLANNING, CLEANUP, BEAUFORT SEA, ICE,
0723 OIL SPILLS, CONTINGENCY PLANNING, CLEANUP, COASTS, CANADA,
0724 OIL SPILLS, CONTINGENCY PLANNING, INLAND, CANADA, PERSONNEL TRAINING,
0725 OIL SPILLS, CONTINGENCY PLANNING, CLEANUP, POLLUTION CONTROL, ECONOMICS, LOCAL
GOVERNMENTS,
0730 OIL SPILLS, POLLUTION PREVENTION, STORAGE, PETROLEUM PRODUCTS, CONTINGENCY PLANNING,
OIL STORAGE PLAN,
0734 OIL SPILLS, POLLUTION PREVENTION, OCEANS, STORAGE, ENVIRONMENTAL EFFECTS,
0735 OIL SPILLS, POLLUTION CONTROL, DETECTION, CONTAINMENT, RECOVERY, DISPOSAL,

[illegible] OIL SPILLS: POLLUTION CONTROL, SOCIO-ECONOMIC EFFECTS, MODELS, POLLUTER RESPONSE,
[illegible] OIL SPILLS: [illegible]
[illegible] OIL SPILLS: [illegible]
[illegible] OIL SPILLS: [illegible], OIL-WATER SEPARATION, CONTINGENCY PLANNING, [illegible]

0749 OIL SPILLS: POLLUTION CONTROL, CLEANUP, DESIGN-ENGINEERING, USCG, EQUIPMENT DELIVERY SYSTEM

[illegible] OIL SPILLS: PERSONNEL TRAINING, POLLUTION CONTROL, CONTINGENCY PLANNING,
[illegible] OIL SPILLS: POLLUTION CONTROL, [illegible], MOVEMENT, [illegible],
[illegible]

[illegible] OIL SPILLS: [illegible]
[illegible] OIL SPILLS: [illegible], CONTAINMENT,
[illegible]

[illegible] OIL SPILLS: POLLUTION CONTROL, [illegible], ENVIRONMENTAL EFFECTS, CLEANUP,
[illegible] OIL SPILLS: [illegible]
[illegible] OIL SPILLS: [illegible]
[illegible] OIL SPILLS: [illegible], BIOLOGICAL EFFECTS, [illegible], PLANKTON, FISH, BENTHOS,
[illegible]

[illegible] OIL SPILLS: BIOLOGICAL EFFECTS, RESTORATION, MARINE ORGANISMS, SAN FRANCISCO BAY,
[illegible] OIL SPILLS: BIOLOGICAL EFFECTS, TROPICAL REGIONS, MARINE ORGANISMS, INTERTIDAL ZONE,
[illegible] CORAL [illegible], FLORIDA, COAST

[illegible] OIL SPILLS: ENVIRONMENTAL EFFECTS, CONTAMINATION, MARINE ORGANISMS, SEDIMENTS,
CONTAINMENT, CLEANUP, MAINE, [illegible]

[illegible] OIL SPILLS: CRUDE OIL, SAMPLING, BIOLOGICAL EFFECTS, ARCTIC, CANADA,
[illegible] OIL SPILLS: BIOLOGICAL EFFECTS, MARSHES, MARINE ORGANISMS, MOLLUSKS, CHESAPEAKE BAY,
MARSH AREAS

[illegible] OIL SPILLS: BIOLOGICAL EFFECTS, [illegible], MICROORGANISMS, SOIL, CANADA,
[illegible] OIL SPILLS: [illegible]
[illegible] OIL SPILLS: BIOLOGICAL EFFECTS, CONTAMINATION, MARINE ORGANISMS, TROPICAL REGIONS,
[illegible]

[illegible] OIL SPILLS: FUEL OIL, BIOLOGICAL EFFECTS, RESTORATION, STREAMS, INVERTEBRATES, FISH,
[illegible]

[illegible] OIL SPILLS: ARCTIC, PLANTS, ANIMALS, [illegible]
[illegible] OIL SPILLS: [illegible]
[illegible] OIL SPILLS: [illegible]
[illegible] OIL SPILLS: [illegible], GUATEMALA,
[illegible] OIL SPILLS: [illegible]
[illegible] OIL SPILLS: [illegible]
[illegible] OIL SPILLS: [illegible], ENVIRONMENTAL EFFECTS, MODELS, WILDLIFE, ECONOMIC EFFECTS,
WORLD [illegible]

[illegible] OIL SPILLS: ENVIRONMENTAL EFFECTS, HYDROCARBONS, CLEANUP, DISPERSANTS, SHORELINES,
PORTUGAL

[illegible] OIL SPILLS: ENVIRONMENTAL EFFECTS, BIODEGRADATION, SOURCES, CLEANUP, RECOVERY, TRADE
[illegible]

[illegible] OIL SPILLS: TANKERS, AMOCO CADIZ SPILL, HYDROCARBONS, FATE, TOXICITY,
[illegible] OIL SPILLS: [illegible], BIOLOGICAL EFFECTS, FATE, ENVIRONMENTAL
EFFECTS, MARINE ORGANISMS, [illegible]

[illegible] OIL SPILLS: [illegible], LAW ENFORCEMENT, REGULATIONS,
[illegible] OIL SPILLS: OFFSHORE DEVELOPMENT, OCS, BIOLOGICAL EFFECTS, MARINE ORGANISMS, ATLANTIC
OCEAN

[illegible] OIL SPILLS: OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, FISHERIES, MARINE ORGANISMS,
GEORGES BANK

[illegible] OIL SPILLS: OIL INDUSTRY, OFFSHORE DEVELOPMENT, ENVIRONMENTAL DETERIORATION, DELAWARE,
GOVERNMENT AGENCIES, COASTAL [illegible]

[illegible] OIL SPILLS: OFFSHORE DEVELOPMENT, OCS, EPA, ENVIRONMENTAL MANAGEMENT, WATER QUALITY,
ATLANTIC COAST

[illegible] OIL SPILLS: OFFSHORE DRILLING, SEABOARD, COASTS, NEW YORK,
[illegible] OIL SPILLS: OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS
[illegible] OIL SPILLS: OIL-GAS LEASING, OCS, FATE, ENVIRONMENTAL EFFECTS, ATLANTIC OCEAN, RISK
ANALYSIS

[illegible] OIL SPILLS: OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, PIPELINES, FLORIDA,
[illegible] OIL SPILLS: [illegible]
[illegible] OIL SPILLS: OFFSHORE [illegible], TANKERS, OIL TRANSPORT,
[illegible]

[illegible] OIL SPILLS: EXPLORATION-PRODUCTION, ARCTIC, ENVIRONMENTAL EFFECTS, PLANTS,
WILDLIFE, MARINE ORGANISMS

[illegible] OIL SPILLS: BIODEGRADATION, WASTE OIL, MICROORGANISMS, PATENT, AFRICA/SOUTH,
[illegible] OIL SPILLS: BIODEGRADATION, BACTERIA, CLEANUP, MICROBIAL GENETIC ENGINEERING,
[illegible] OIL SPILLS: BIODEGRADATION, [illegible]
[illegible] OIL SPILLS: BIODEGRADATION, SOIL, DECOMPOSITION, MICROORGANISMS, MODELS, NUTRIENT
DEMAND

[illegible] OIL SPILLS: BIODEGRADATION, MICROORGANISMS,
[illegible] OIL SPILLS: BIODEGRADATION, SEDIMENTS, BACTERIA, CHESAPEAKE BAY, COLGATE CREEK,
[illegible] OIL SPILLS: HYDROCARBONS, EVAPORATION, SOLUTION,
[illegible] OIL SPILLS: OFFSHORE DRILLING, ICE, MOVEMENT, BEHAVIOR, ENVIRONMENTAL EFFECTS, ARCTIC,

[illegible]
[illegible] OIL SPILLS; [illegible]
[illegible] OIL SPILLS; [illegible]
[illegible]
[illegible] OIL SPILLS; [illegible] EVAPORATION, WEATHERING
[illegible] OIL SPILLS; [illegible]
[illegible] OIL SPILLS; [illegible] BIODEGRADATION, OXIDATION, TAR,
[illegible] OIL SPILLS; [illegible]
[illegible] OIL SPILLS; [illegible] EMULSIFICATION, WEATHERING,
[illegible] OIL SPILLS; [illegible]
[illegible] OIL SPILLS; [illegible] GROUNDWATER, PERSISTENCE,
[illegible] OIL SPILLS; [illegible]
[illegible] OIL SPILLS; [illegible] STORM MODELING,
[illegible] OIL SPILLS; [illegible]
[illegible] OIL SPILLS; [illegible] SOLUTION, EMULSIFICATION,
ADSORPTION, DECOMPOSITION
[illegible] OIL SPILLS; MODELS, HYDROCARBONS, OCEANS, FATE, SPREADING, EVAPORATION, BIODEGRADATION,
[illegible] OIL SPILLS; FATE, TOXICITY, CONTAMINATION, MARINE ORGANISMS, API
[illegible] OIL SPILLS; OFFSHORE DRILLING, MODELS, MOVEMENT, COASTS, [illegible] NEW JERSEY, DELAWARE,
[illegible] OIL SPILLS; FATE, ARCTIC, CRUDE OIL, EVAPORATION, WEATHERING, SOLUTION,
EMULSIFICATION, TAR
[illegible] OIL SPILLS; CRUDE OIL, WEATHERING, TAR, EVAPORATION, SOLUTION, SULFUR COMPOUNDS,
[illegible] OIL SPILLS; BEACHES, FATE, MOVEMENT, SEDIMENTS, BIOLOGICAL EFFECTS, PLANKTON,
BENTHOS, CHESAPEAKE BAY
[illegible] OIL SPILLS; FATE, MODELS, DRIFT, SPREADING, DELAWARE BAY
[illegible] OIL SPILLS; ENVIRONMENTAL DETERIORATION, COMPENSATION, WILDLIFE, MARINE ORGANISMS,
ECONOMICS, GLOBAL ASPECTS
[illegible] OIL SPILLS; LEGISLATION, US, LIABILITY, COMPENSATION, SUPER-FUND
1000 OIL SPILLS; BIBLIOGRAPHIES, SOURCE IDENTIFICATION, ANALYTICAL TECHNIQUES,
SPECTROSCOPY, INSTRUMENTS, CHROMATOGRAPHY
1001 OIL SPILLS; OFFSHORE DRILLING, BIBLIOGRAPHIES, LEGISLATION, US, INTERNATIONAL
AGREEMENTS, OCEANS, SHIPS, POLLUTION PREVENTION
1004 OIL SPILLS; BIBLIOGRAPHIES, OIL-WATER SEPARATION, POLLUTION CONTROL, RECOVERY,
BALLAST, BILGES
[illegible] OIL TANKS; TANKERS, CLEANUP, EXPLOSIONS, SAFETY SYSTEMS
[illegible] OIL TANKS; MONITORING, LEAKAGE, DETECTION, DESIGN-ENGINEERING, PATENT,
[illegible] OIL TANKS; TANKERS, CLEANUP, SURFACTANTS
[illegible] OIL TANKS; LEAKAGE, GASOLINE, RECOVERY, CONTAINMENT, GROUNDWATER
[illegible] OIL TANKS; LEAKAGE, SOIL, POLLUTION PREVENTION, STORAGE, DESIGN-ENGINEERING, PATENT,
[illegible] OIL TANKS; LEAKAGE, DETECTION, DESIGN-ENGINEERING, PATENT
[illegible] OIL TANKS; LEAKAGE, DETECTION, DESIGN-ENGINEERING, PATENT
[illegible] OIL TRANSFER; HYDROCARBONS, OCEANS, DISTRIBUTION, MARINE ORGANISMS, FOOD WEB,
*TRANSFER PROCESSES
[illegible] OIL TRANSFER; PORTS, FLORIDA, MEXICO/GULF OF, ENVIRONMENTAL EFFECTS, SOCIO-ECONOMIC
EFFECTS, LEGISLATION, DEEPWATER PORTS
[illegible] OIL TRANSFER; OIL DISCHARGES, POLLUTION PREVENTION, STATISTICAL ANALYSIS, REGULATIONS,
USCG
[illegible] OIL TRANSFER; PORTS, LEGISLATION, DELAWARE BAY
[illegible] OIL TRANSFER; OIL DISCHARGES, REGULATIONS, US, SHIPS, BILGES, USCG
[illegible] OIL TRANSPORT; OIL SPILLS, SOURCE IDENTIFICATION, ANALYTICAL TECHNIQUES, POLLUTION
PREVENTION, USCG
[illegible] OIL TRANSPORT; OIL SPILLS, SHIPS, TANKERS, POLLUTION PREVENTION, OIL-WATER SEPARATION,
[illegible] OIL TRANSPORT; TANKERS, REGULATIONS, LAW ENFORCEMENT, WASHINGTON, PUGET SOUND
[illegible] OIL TRANSPORT; ENVIRONMENTAL EFFECTS, PIPELINES, ECONOMIC EFFECTS, ALASKA, CALIFORNIA,
[illegible] OIL TRANSPORT; PIPELINES, ENVIRONMENTAL EFFECTS, ESTUARIES, PLANTS, ANIMALS,
MONITORING, FLORIDA
[illegible] OIL TRANSPORT; OIL SPILLS, TANKERS, ECONOMICS, POLLUTION CONTROL, REGULATIONS,
*STANDARDS
[illegible] OIL TRANSPORT; OIL SPILLS, PIPELINES, TANKERS, STATISTICAL ANALYSIS
[illegible] OIL TRANSPORT; OIL SPILLS, PORTS, STORAGE, SOCIAL EFFECTS, ENVIRONMENTAL EFFECTS,
PACIFIC OCEAN, PALAU, SUPERPORT
[illegible] OIL TRANSPORT; OFFSHORE EXPLORATION, CONTAMINANTS, SPREADING, DISPERSIONS, PLATFORMS,
[illegible] OIL TRANSPORT; OIL SPILLS, OFFSHORE DRILLING, OCS, BLOWOUT PREVENTION, TANKERS,
ATLANTIC COAST, CALIFORNIA COAST, MEXICO/GULF OF
[illegible] OIL-WATER SEPARATION; MONITORING, WASTEWATERS, PATENT
[illegible] OIL-WATER SEPARATION; MONITORING, WASTEWATERS, BILGES, SHIPS, PATENT,
[illegible] OIL-WATER SEPARATION; OIL SLICKS, RECOVERY, SKIMMERS
[illegible] OIL-WATER SEPARATION; OIL SPILLS, RECOVERY, BOOMS, SKIMMERS, DESIGN-ENGINEERING,
*SORBENTS
[illegible] OIL-WATER SEPARATION; OIL SPILLS, RECOVERY, CRUDE OIL, FUEL OIL, SKIMMERS, CANADA,
[illegible] OIL-WATER SEPARATION; OIL SPILLS, RECOVERY, SKIMMERS, DESIGN-ENGINEERING
[illegible] OIL-WATER SEPARATION; OIL TRANSPORT, OIL SPILLS, SHIPS, TANKERS, POLLUTION PREVENTION,
[illegible] OIL-WATER SEPARATION; DESIGN-ENGINEERING, PATENT
[illegible] OIL-WATER SEPARATION; DESIGN-ENGINEERING, PATENT
[illegible] OIL-WATER SEPARATION; WASTEWATER TREATMENT, REFINERIES, BELGIUM,

0681 OIL-WATER SEPARATION, WASTEWATER TREATMENT, CONTAMINANTS, COALESCENCE,
[illegible] OIL-WATER SEPARATION, [illegible] COALESCENCE, DESIGN-ENGINEERING, PATENT,
[illegible] OIL-WATER SEPARATION, [illegible] DESIGN-ENGINEERING,
[illegible] OIL-WATER SEPARATION, [illegible] PATENT,
[illegible] OIL-WATER SEPARATION, [illegible] TUBULAR
0681 OIL-WATER SEPARATION, WASTEWATER TREATMENT, ADSORPTION, PRECIPITATION, PH CONTROL,
[illegible] OIL-WATER SEPARATION, WASTEWATER TREATMENT, [illegible] PATENT,
[illegible] OIL-WATER SEPARATION, [illegible]
[illegible] OIL-WATER SEPARATION, [illegible] TREATMENT, COALESCENCE, FLOTATION,
[illegible] OIL-WATER SEPARATION, WASTEWATER TREATMENT, ADSORPTION, [illegible]
[illegible] OIL-WATER SEPARATION, WASTEWATER TREATMENT, [illegible] PATENT,
[illegible] OIL-WATER SEPARATION, [illegible] PATENT,
[illegible] OIL-WATER SEPARATION, [illegible] TREATMENT, [illegible] WATER QUALITY, [illegible]
0700 OIL-WATER SEPARATION, WASTEWATER TREATMENT, FLOTATION, PATENT,
[illegible] OIL-WATER SEPARATION, [illegible] DESIGN-ENGINEERING, [illegible]
[illegible] OIL-WATER SEPARATION, WASTEWATER TREATMENT, ADSORPTION, PATENT,
[illegible] OIL-WATER SEPARATION, [illegible] INTERNATIONAL CONVENTIONS, SHIPS, CONTINGENCY
PLANNING, POLLUTION PREVENTION, [illegible]
0994 OIL-WATER SEPARATION, [illegible] WASTEWATER TREATMENT, PRODUCTION, STORAGE,
DISTRIBUTION, POLLUTION CONTROL
1004 OIL-WATER SEPARATION, OIL SPILLS, BIBLIOGRAPHIES, POLLUTION CONTROL, RECOVERY,
BALLAST, BILGES
[illegible] OIL, [illegible] OIL-WATER SEPARATION, DESIGN-ENGINEERING, PATENT,
[illegible] OIL, [illegible] PETROLEUM WASTE,
[illegible] ONSHORE IMPACTS, [illegible]
[illegible] ONSHORE IMPACTS, [illegible] FLORIDA,
[illegible] ONSHORE IMPACTS, OIL INDUSTRY, OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, CALIFORNIA
COAST
0087 ONSHORE IMPACTS, OFFSHORE EXPLORATION, OFFSHORE DEVELOPMENT, SOCIO-ECONOMIC EFFECTS,
FLORIDA
0088 ONSHORE IMPACTS, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, SOCIO-ECONOMIC EFFECTS,
[illegible] BENZO(A)PYRENE,
[illegible] OIL SPILLS, CLEANUP, SEAWATER, MOLLUSKS, WATER PURIFICATION, MUSSELS,
MYTILUS EDULIS
[illegible] OXIDATION, BIODEGRADATION, HYDROCARBONS, SOIL, MICROORGANISMS, OXYGEN UPTAKE RATE,
[illegible] OXIDATION, BIODEGRADATION, [illegible]
[illegible] OXIDATION, BIODEGRADATION, [illegible] ATLANTIC OCEAN,
[illegible] OXIDATION, BIODEGRADATION, CRUDE OIL, PETROLEUM PRODUCTS, ENVIRONMENTAL EFFECTS
MICROORGANISMS
[illegible] OXIDATION, FUEL OIL, TOXICITY, [illegible] HYDROCARBONS,
[illegible] OXIDATION, OIL SPILLS, CRUDE OIL, FATE, EVAPORATION, [illegible] BIODEGRADATION, TAR,
[illegible] OXIDATION, CRUDE OIL, CHEMICAL ANALYSIS, CHROMATOGRAPHY, EVAPORATION, BIODEGRADATION,
PHOTOOXIDATION
[illegible] PACIFIC OCEAN, SAMPLING, HYDROCARBONS, CHEMICAL ANALYSIS, TANKER ROUTES,
[illegible] PACIFIC OCEAN, SAMPLING, HYDROCARBONS, [illegible] TANKER ROUTES,
[illegible] PACIFIC OCEAN, OIL TRANSPORT, OIL SPILLS, PORTS, STORAGE, SOCIAL EFFECTS,
ENVIRONMENTAL EFFECTS, PALAU, SUPERPORT
0486 PAH, MONITORING, COASTS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, SAMPLING, CARCINOGENS,
FLUORIMETRY, COASTAL WATERS
0487 PAH, MONITORING, MOLLUSKS, CALIFORNIA/SOUTHERN, CARCINOGENS, MUSSELS,
BENZO(A)PYRENE
[illegible] PAH, CHEMICAL ANALYSIS, CHROMATOGRAPHY, MARINE ORGANISMS, POLLUTION,
[illegible] PAH, CHEMICAL ANALYSIS, CHROMATOGRAPHY, PETROLEUM PRODUCTS, SEDIMENTS, WASTEWATERS,
LIQUID CHROMATOGRAPHY
[illegible] PAH, CHEMICAL ANALYSIS, CHROMATOGRAPHY, HYDROCARBONS, SOIL, THIN-LAYER CHROMATOGRAPHY,
[illegible] PAH, OIL SPILLS, SOURCE IDENTIFICATION, [illegible] CHEMICAL ANALYSIS,
[illegible] PAH, HYDROCARBONS, METABOLISM, MARINE ORGANISMS, BENZO(A)PYRENE, MICROSOMAL
MIXED-FUNCTION OXIDASES
[illegible] PAH, OREGON, CARCINOGENS, MOLLUSKS, ESTUARIES, ECONOMIC EFFECTS, BENZO(A)PYRENE,
[illegible] PAH, OCEANS
[illegible] PAH, BIODEGRADATION, AROMATIC HYDROCARBONS, CARCINOGENS, MICROORGANISMS,
[illegible] PAH, BIODEGRADATION, MICROORGANISMS, BACTERIA, CARCINOGENS,
[illegible] PAH, HYDROCARBONS, FATE, ESTUARIES, [illegible] ATLANTIC COAST, ADSORPTION, BIODEGRADATION,
[illegible] PAH, CARCINOGENS, FATE, DECOMPOSITION, ENVIRONMENTAL EFFECTS,

1002 PAH, BIBLIOGRAPHIES, FUEL OIL, CARCINOGENS, ANALYTICAL TECHNIQUES, PETROLEUM PRODUCTS,

1003 PAH, BIBLIOGRAPHIES, SOURCES, FATE, ANALYTICAL TECHNIQUES, CHROMATOGRAPHY, SPECTROSCOPY, CARCINOGENS, CRUDE OIL,

0584 PATENT, OIL SLICKS, MONITORING, *OIL CONTENT, *ECHO SOUNDING,

0581 PATENT, OIL-WATER SEPARATION, MONITORING, WASTEWATERS,

0586 PATENT, OIL TANKS, MONITORING, LEAKAGE, DETECTION, DESIGN-ENGINEERING,

0502 PATENT, OIL SLICKS, MONITORING, LEAKAGE, PIPELINES, WASTEWATERS, DETECTION, DESIGN-ENGINEERING,

0503 PATENT, MONITORING, HYDROCARBONS, DETECTION, DESIGN-ENGINEERING,

0507 PATENT, OIL-WATER SEPARATION, MONITORING, WASTEWATERS, BILGES, SHIPS,

0570 PATENT, OIL SLICKS, CONTAINMENT, BOOMS, DESIGN-ENGINEERING,

0571 PATENT, OIL SPILLS, CONTAINMENT, BOOMS, DESIGN-ENGINEERING,

0576 PATENT, OIL SPILLS, CONTAINMENT, COAGULATION, *POLYMERS,

0585 PATENT, OIL SPILLS, CLEANUP, RECOVERY, DESIGN-ENGINEERING, *OLEOPHILIC SPONGE,

0590 PATENT, OIL SLICKS, RECOVERY, DESIGN-ENGINEERING, *OLEOPHILIC CONTAINER,

0592 PATENT, OIL SLICKS, RECOVERY, SKIMMERS, DESIGN-ENGINEERING,

0593 PATENT, OIL SLICKS, DISPERSANTS, HYDROCARBONS, CLEANUP, BIODEGRADATION, *NITROGEN COMPOUNDS,

0594 PATENT, OIL SLICKS, DISPERSANTS, HYDROCARBONS, CLEANUP, BIODEGRADATION, *NITROGEN COMPOUNDS,

0595 PATENT, OIL SLICKS, DISPERSANTS, HYDROCARBONS, CLEANUP, BIODEGRADATION, *NITROGEN COMPOUNDS,

0601 PATENT, OIL SLICKS, SKIMMERS, RECOVERY, DESIGN-ENGINEERING,

0605 PATENT, OIL SPILLS, HYDROCARBONS, CLEANUP, BIODEGRADATION, BACTERIA,

0607 PATENT, OIL SLICKS, CLEANUP, PETROLEUM PRODUCTS, ABSORPTION, DESIGN-ENGINEERING,

0610 PATENT, OIL SLICKS, SKIMMERS, RECOVERY, DESIGN-ENGINEERING,

0612 PATENT, OIL SPILLS, RECOVERY, CONTAINMENT, DESIGN-ENGINEERING, *COLLECTION BARGE,

0613 PATENT, WASTE OIL, CLEANUP, ABSORPTION,

0626 PATENT, OIL SPILLS, RECOVERY, SKIMMERS, DESIGN-ENGINEERING,

0629 PATENT, ABSORPTION, CONTAMINANTS, *POLYURETHANE FOAM,

[illegible] PATENT, OIL SLICKS, SKIMMERS, RECOVERY, DESIGN-ENGINEERING,

[illegible] PATENT, OIL-WATER SEPARATION, DESIGN-ENGINEERING,

0653 PATENT, OIL-WATER SEPARATION, DESIGN-ENGINEERING,

0673 PATENT, OIL-WATER SEPARATION, WASTEWATER TREATMENT, CONTAMINANTS, COALESCENCE, DESIGN-ENGINEERING,

0664 PATENT, OIL-WATER SEPARATION, DISPERSIONS, COALESCENCE, DESIGN-ENGINEERING,

0665 PATENT, OIL-WATER SEPARATION, EMULSIONS, COALESCENCE,

0670 PATENT, OIL SPILLS, CLEANUP, WASTE OIL, ABSORPTION, *METALLURGICAL PUMICE,

0678 PATENT, OIL-WATER SEPARATION, WASTEWATER TREATMENT, BALLAST, COALESCENCE,

0681 PATENT, OIL-WATER SEPARATION, WASTEWATER TREATMENT, ABSORPTION, PRECIPITATION, PH CONTROL,

0683 PATENT, OIL-WATER SEPARATION, WASTEWATER TREATMENT, ABSORPTION, *POLYOLEFIN,

0685 PATENT, WASTE OIL, RECLAMATION, REFINING,

0686 PATENT, OIL-WATER SEPARATION, WASTEWATER TREATMENT, COALESCENCE, DESIGN-ENGINEERING,

0687 PATENT, OIL-WATER SEPARATION, WASTEWATER TREATMENT, COALESCENCE, FLOTATION, DESIGN-ENGINEERING,

0688 PATENT, OIL-WATER SEPARATION, WASTEWATER TREATMENT, EMULSIONS, COAGULATION,

0692 PATENT, OIL-WATER SEPARATION, WASTEWATER TREATMENT, DESIGN-ENGINEERING,

0693 PATENT, WASTEWATER TREATMENT, WASTE OIL, EMULSIONS,

0696 PATENT, WASTEWATER TREATMENT, PETROLEUM PRODUCTS,

0697 PATENT, WASTEWATER TREATMENT, EXTRACTION, CONTAMINANTS, DESIGN-ENGINEERING,

0698 PATENT, OIL WELLS, OIL-WATER SEPARATION, DESIGN-ENGINEERING,

0700 PATENT, OIL-WATER SEPARATION, WASTEWATER TREATMENT, FLOTATION,

0702 PATENT, OIL-WATER SEPARATION, WASTEWATER TREATMENT, ABSORPTION,

0703 PATENT, WASTE OIL, TREATMENT, ABSORPTION,

0707 PATENT, WASTE OIL, LUBRICATING OIL, RECLAMATION,

0727 PATENT, OIL TANKS, LEAKAGE, SOIL, POLLUTION PREVENTION, STORAGE, DESIGN-ENGINEERING,

0728 PATENT, OIL TANKS, LEAKAGE, DETECTION, DESIGN-ENGINEERING,

0730 PATENT, LEAKAGE, DETECTION, PETROLEUM PRODUCTS,

0733 PATENT, BLOWOUT PREVENTION, DRILLING, DESIGN-ENGINEERING,

0737 PATENT, LEAKAGE, PIPELINES, POLLUTION PREVENTION, *SEALING MATERIAL,

0738 PATENT, POLLUTION CONTROL, LUBRICATING OIL,

0739 PATENT, POLLUTION PREVENTION, LUBRICATING OIL,

0750 PATENT, OIL TANKS, LEAKAGE, DETECTION, DESIGN-ENGINEERING,

0807 PATENT, OIL SPILLS, BIODEGRADATION, WASTE OIL, MICROORGANISMS, AFRICA/SOUTH,

0866 PENNSYLVANIA, OIL SPILLS, WASTE OIL, RIVERS, ENVIRONMENTAL EFFECTS, VEGETATION, *ECOLOGICAL SPILL,

0867 PENNSYLVANIA, BIODEGRADATION, GASOLINE, GROUNDWATER, *NUTRIENT ADDITION,

0710 PERSONNEL TRAINING, OIL SPILLS, POLLUTION PREVENTION, CLEANUP, CONTINGENCY PLANNING, TEXAS,

0711 PERSONNEL TRAINING, OIL SPILLS, POLLUTION CONTROL, CONTINGENCY PLANNING, USCG, *[illegible] EXERCISE,

0712 PERSONNEL TRAINING, OIL SPILLS, POLLUTION CONTROL, CLEANUP, CONTINGENCY PLANNING, CANADA,

0713 PERSONNEL TRAINING, OIL SPILLS, TEXAS, *SPILL CONTROL COURSE,

0714 PERSONNEL TRAINING, OIL SPILLS, OIL INDUSTRY, POLLUTION CONTROL, CLEANUP, RECOVERY,
RESTORATION,
0715 PERSONNEL TRAINING, OIL SPILLS, OIL INDUSTRY, CONTINGENCY PLANNING, POLLUTION CONTROL,
CLEANUP, CANADA,
0718 PERSONNEL TRAINING, OIL SPILLS, OIL FIELDS, CONTINGENCY PLANNING, CLEANUP, NORTH SEA,
*BP FORTIES OILFIELD,
0723 PERSONNEL TRAINING, OIL SPILLS, CONTINGENCY PLANNING, INLAND, CANADA,
0755 PERSONNEL TRAINING, OIL SPILLS, POLLUTION CONTROL, CONTINGENCY PLANNING,
0535 PETROCHEMICALS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, CONTAMINANTS, WASTEWATERS,
PETROLEUM PRODUCTS, *GAS CHROMATOGRAPHY
0552 PETROCHEMICALS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, HYDROCARBONS, PETROLEUM PRODUCTS,
FUELS, WASTEWATERS,
0600 PETROCHEMICALS, WASTEWATER TREATMENT, ECONOMICS, LEGISLATION, GERMANY, WEST,
0608 PETROCHEMICALS, WASTEWATER TREATMENT,
0705 PETROCHEMICALS, DISPOSAL, WASTE OIL, STORAGE, MANUALS, USA,
[illegible] PETROCHEMICALS, BIODEGRADATION, MICROORGANISMS, [illegible]
0526 PETROLEUM PRODUCTS, OIL SLICKS, DETECTION, ANALYTICAL TECHNIQUES, ABSORPTION,
0535 PETROLEUM PRODUCTS, PETROCHEMICALS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, CONTAMINANTS,
WASTEWATERS, *GAS CHROMATOGRAPHY
0552 PETROLEUM PRODUCTS, PETROCHEMICALS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, HYDROCARBONS,
FUELS, WASTEWATERS,
0551 PETROLEUM PRODUCTS, CHEMICAL ANALYSIS, WASTEWATERS, MONITORING,
0556 PETROLEUM PRODUCTS, PAH, CHEMICAL ANALYSIS, CHROMATOGRAPHY, REFINERIES, WASTEWATERS,
*LIQUID CHROMATOGRAPHY
0561 PETROLEUM PRODUCTS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, SPECTROMETRY, CRUDE OIL,
HYDROCARBONS, EVAPORATION, *WATER-SOLUBLE FRACTIONS,
0607 PETROLEUM PRODUCTS, PATENT, OIL SLICKS, CLEANUP, ABSORPTION, DESIGN-ENGINEERING,
0655 PETROLEUM PRODUCTS, PATENT, WASTEWATER TREATMENT,
0730 PETROLEUM PRODUCTS, OIL SPILLS, POLLUTION PREVENTION, STORAGE, CONTINGENCY PLANNING,
*OIL STORAGE PLAN
0750 PETROLEUM PRODUCTS, PATENT, LEAKAGE, DETECTION,
0783 PETROLEUM PRODUCTS, CRUDE OIL, HYDROCARBONS, TOXICITY, MARINE ORGANISMS, ECOSYSTEMS,
0785 PETROLEUM PRODUCTS, FUELS, TOXICITY, PHYTOPLANKTON,
0786 PETROLEUM PRODUCTS, TOXICITY, HYDROCARBONS,
0798 PETROLEUM PRODUCTS, TOXICITY, AROMATIC HYDROCARBONS, MARINE ORGANISMS, *SUBLETHAL
EFFECTS, *RESPIRATION, *GROWTH,
0936 PETROLEUM PRODUCTS, BIODEGRADATION, MICROORGANISMS, BARENT SEA, BALTIC SEA, ATLANTIC
OCEAN,
0940 PETROLEUM PRODUCTS, BIODEGRADATION, CRUDE OIL, BACTERIA, CASPIAN SEA, USSR,
0941 PETROLEUM PRODUCTS, OXIDATION, BIODEGRADATION, CRUDE OIL, ENVIRONMENTAL EFFECTS,
MICROORGANISMS,
1042 PETROLEUM PRODUCTS, BIODEGRADATION, MICROORGANISMS, HYDROCARBONS, CRUDE OIL,
GROUNDWATER, USSR,
0987 PETROLEUM PRODUCTS, REGULATIONS, CRUDE OIL, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS,
FEA, *MANDATORY OIL IMPORT PROGRAM
1002 PETROLEUM PRODUCTS, PAH, BIBLIOGRAPHIES, FUEL OIL, CARCINOGENS, ANALYTICAL TECHNIQUES,
0681 PH CONTROL, PATENT, OIL-WATER SEPARATION, WASTEWATER TREATMENT, ABSORPTION,
PRECIPITATION
0785 PHYTOPLANKTON, PETROLEUM PRODUCTS, FUELS, TOXICITY,
0458 PIPELINES, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ECONOMICS, ALASKA,
*TRANS-ALASKA PIPELINE
0502 PIPELINES, OIL SPILLS, OFFSHORE DEVELOPMENT, STATISTICS, TANKERS, SPILL PREDICTIONS,
0503 PIPELINES, OIL SPILLS, FRESH WATER SPILLS, STATISTICS, CANADA, ALBERTA,
0576 PIPELINES, OIL SPILLS, OIL DISCHARGES, PORTS, REFINERIES, WATER QUALITY, *PETROLEUM
FACILITIES
0602 PIPELINES, PATENT, OIL SLICKS, MONITORING, LEAKAGE, WASTEWATERS, DETECTION,
DESIGN-ENGINEERING,
0683 PIPELINES, OIL SPILLS, CLEANUP, ECONOMICS, TANKERS, ALASKA, *OIL SPILL FUND
0696 PIPELINES, OIL TRANSPORT, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS, ALASKA, CALIFORNIA,
0699 PIPELINES, OIL TRANSPORT, ENVIRONMENTAL EFFECTS, ESTUARIES, PLANTS, ANIMALS,
MONITORING, FLORIDA
0751 PIPELINES, LEAKAGE, DETECTION, *MINI-COMPUTERS,
[illegible] PIPELINES, OIL TRANSPORT, OIL SPILLS, TANKERS, STATISTICAL ANALYSIS,
[illegible] PIPELINES, PATENT, LEAKAGE, POLLUTION PREVENTION, [illegible]
[illegible] PIPELINES, OIL INDUSTRY, DEVELOPMENT, STORAGE, SCOTLAND, *SULLOM VOE TERMINAL
[illegible] PIPELINES, OIL SPILLS, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, FLORIDA,
[illegible] PIPELINES, OIL SPILLS, BEHAVIOR, STATISTICAL ANALYSIS, WEATHERING, CANADA, [illegible]
[illegible] PIPELINES, OIL INDUSTRY, REGULATIONS, STANDARDS, GUIDELINES, EUROPE
0766 PLANKTON, OIL SPILLS, ESTUARIES, BIOLOGICAL EFFECTS, WEATHERING, FISH, BENTHOS,
ATLANTIC COAST,
0879 PLANKTON, OFFSHORE DEVELOPMENT, OCS, ENVIRONMENTAL EFFECTS, ALASKA, BENTHOS,
FISHERIES, BASELINE STUDIES
0979 PLANKTON, OIL SPILLS, BEACHES, FATE, MOVEMENT, SEDIMENTS, BIOLOGICAL EFFECTS,
BENTHOS, CHESAPEAKE BAY,
0633 PLANTS, OIL SPILLS, RESTORATION, SOIL, BIODEGRADATION, *FERTILIZERS,

0455 PLANTS, PIPELINES, OIL TRANSPORT, ENVIRONMENTAL EFFECTS, ESTUARIES, ANIMALS, MONITORING, FLORIDA.

0729 PLANTS, POLLUTION CONTROL, REFINERIES, *NATURAL GAS MONITORING, WASTEWATERS, SOLID WASTES.

0752 PLANTS, FUEL OIL, BIOLOGICAL EFFECTS, TROPICAL REGIONS, MALAYSIA, *PIONEER MANGROVE, AVICENNIA INTERMEDIA.

0813 PLANTS, OIL SPILLS, ARCTIC, ANIMALS, USSR.

0901 PLANTS, OIL SPILLS, EXPLORATION, PRODUCTION, ARCTIC, ENVIRONMENTAL EFFECTS, WILDLIFE, MARINE ORGANISMS.

0553 PLATFORMS, OIL SPILLS, OFFSHORE PRODUCTION, NORTH SEA, *OXYGEN CORROSION.

0615 PLATFORMS, OIL SLICKS, REMOTE SENSING, DETECTION, NATURAL SEEPAGE, SANTA BARBARA CHANNEL, USCG, *SIDE-LOOKING RADAR.

0778 PLATFORMS, HYDROCARBONS, MOLLUSKS, UPTAKE, RELEASE, SEDIMENTS, TEXAS, *TRINITY BAY, *NAPHTHALENES, *CLAM, *RANGIA CUNEATA.

0794 PLATFORMS, OFFSHORE PRODUCTION, OFFSHORE DRILLING, CHRONIC EFFECTS, CRUDE OIL, MARINE ORGANISMS.

0836 PLATFORMS, OFFSHORE DRILLING, BIOLOGICAL EFFECTS, MARINE ORGANISMS, SANTA BARBARA CHANNEL.

0850 PLATFORMS, OIL TRANSPORT, OFFSHORE EXPLORATION, CONTAMINANTS, SPREADING, DISPERSIONS,

0863 PLATFORMS, OFFSHORE DRILLING, OCS, ENVIRONMENTAL EFFECTS, ATLANTIC OCEAN, BLM,

0934 PLATFORMS, DEVELOPMENT, EIS, ENVIRONMENTAL EFFECTS, SCOTLAND.

0501 POLLUTION CONTROL, OIL SPILLS, MONITORING, HYDROCARBONS, SURVEILLANCE, GOVERNMENT AGENCIES, EPA, USGS, USCG, *UN

0512 POLLUTION CONTROL, OIL SPILLS, REMOTE SENSING, CLEANUP, LAW ENFORCEMENT, EPA,

0599 POLLUTION CONTROL, OIL SPILLS, CLEANUP, ECONOMICS, TEXAS, *CORPUS CHRISTI,

0611 POLLUTION CONTROL, OIL SPILLS, CLEANUP, CALIFORNIA, *OAKLAND ESTUARY, *TELECOMMUNICATIONS SYSTEM.

0637 POLLUTION CONTROL, OIL SPILLS, OFFSHORE DRILLING, TANKERS, METULA SPILL, ENVIRONMENTAL PROTECTION.

0650 POLLUTION CONTROL, OIL TRANSPORT, OIL SPILLS, TANKERS, ECONOMICS, REGULATIONS, STANDARDS.

0671 POLLUTION CONTROL, WASTEWATER TREATMENT, REFINERIES, CONSERVATION, *WATER REUSE,

0711 POLLUTION CONTROL, PERSONNEL TRAINING, OIL SPILLS, CONTINGENCY PLANNING, USCG, *AIRTRANSPORT EXERCISE.

0712 POLLUTION CONTROL, PERSONNEL TRAINING, OIL SPILLS, CLEANUP, CONTINGENCY PLANNING, CANADA.

0714 POLLUTION CONTROL, PERSONNEL TRAINING, OIL SPILLS, OIL INDUSTRY, CLEANUP, RECOVERY, RESTORATION.

0716 POLLUTION CONTROL, PERSONNEL TRAINING, OIL SPILLS, OIL INDUSTRY, CONTINGENCY PLANNING, CLEANUP, CANADA.

0725 POLLUTION CONTROL, OIL SPILLS, CONTINGENCY PLANNING, CLEANUP, ECONOMICS, *LOCAL GOVERNMENTS.

0726 POLLUTION CONTROL, OIL DISCHARGES, LEGISLATION, EUROPE, *MARINE POLLUTION.

0729 POLLUTION CONTROL, PLANTS, REFINERIES, *NATURAL GAS MONITORING, WASTEWATERS, SOLID WASTES.

0733 POLLUTION CONTROL, OIL SPILLS, DETECTION, CONTAINMENT, RECOVERY, DISPOSAL.

0736 POLLUTION CONTROL, OIL SPILLS, SOCIO-ECONOMIC EFFECTS, MODELS, *POLLUTER RESPONSE,

0741 POLLUTION CONTROL, OIL INDUSTRY, REFINERIES, EPA.

0742 POLLUTION CONTROL, OIL SPILLS, CLEANUP, DESIGN-ENGINEERING, USCG, *EQUIPMENT DELIVERY SYSTEM.

0754 POLLUTION CONTROL, PERSONNEL TRAINING, OIL SPILLS, CONTINGENCY PLANNING.

0755 POLLUTION CONTROL, OIL SPILLS, ESTUARIES, HARBORS, MOVEMENT, *GRASS-CUTTING, *HACKENSACK ESTUARY.

0758 POLLUTION CONTROL, PATENT, LUBRICATING OIL.

0792 POLLUTION CONTROL, OIL SPILLS, OCEANS, ISLANDS, ENVIRONMENTAL EFFECTS, CLEANUP,

0816 POLLUTION CONTROL, OIL SPILLS, ECONOMIC EFFECTS, TOXICITY, *SHELL OIL CO.,

0843 POLLUTION CONTROL, ENVIRONMENTAL EFFECTS, REGULATIONS, LEGISLATION, US.

0853 POLLUTION CONTROL, OIL INDUSTRY, REGULATIONS, ECONOMICS, REFINING, EXPLORATION, PRODUCTION.

0861 POLLUTION CONTROL, OIL INDUSTRY, ENVIRONMENTAL EFFECTS, CONTAMINATION.

0864 POLLUTION CONTROL, EXPLORATION, SEAWATER.

0900 POLLUTION CONTROL, OFFSHORE DRILLING, BLOWOUT PREVENTION, ARCTIC, BEAUFORT SEA.

0930 POLLUTION CONTROL, OXIDATION, BIODEGRADATION, MICROORGANISMS, BACTERIA, ATLANTIC OCEAN,

0948 POLLUTION CONTROL, GROUNDWATER, CONTAMINATION, HYDROCARBONS, MOVEMENT.

0958 POLLUTION CONTROL, OFFSHORE DEVELOPMENT, OCS, LEGISLATION, US, ENVIRONMENTAL EFFECTS, ECONOMICS, DELAWARE.

0968 POLLUTION CONTROL, OIL INDUSTRY, LEGISLATION, US, REFINERIES, ECONOMIC EFFECTS,

0980 POLLUTION CONTROL, LEGISLATION, CLEANUP, LIABILITY, COST ANALYSIS, *FEDERAL WATER POLLUTION CONTROL ACT.

0998 POLLUTION CONTROL, OIL-WATER SEPARATION, PIPELINES, WASTEWATER TREATMENT, PRODUCTION STORAGE, DISTRIBUTION.

1004 POLLUTION CONTROL, OIL-WATER SEPARATION, OIL SPILLS, BIBLIOGRAPHIES, RECOVERY, BALLAST, BILGES.

0467 POLLUTION PREVENTION, OIL SPILLS, BIOLOGICAL EFFECTS, CLEANUP, SURVEILLANCE, INTERNATIONAL AGREEMENTS.

0875 POLLUTION PREVENTION; OIL SPILLS, CLEANUP, BIRDS, WILDLIFE, CHESAPEAKE BAY, USCG,
0867 POLLUTION PREVENTION; OIL TRANSPORT, OIL SPILLS, SOURCE IDENTIFICATION, ANALYTICAL TECHNIQUES, USCG,
0626 POLLUTION PREVENTION; OIL-WATER SEPARATION, OIL TRANSPORT, OIL SPILLS, SHIPS, TANKERS;
0646 POLLUTION PREVENTION; OIL TRANSFER, OIL DISCHARGES, STATISTICAL ANALYSIS, REGULATIONS, USCG,
0661 POLLUTION PREVENTION; WASTEWATER TREATMENT, REFINERIES, SURFACE WATERS, BELGIUM,
0710 POLLUTION PREVENTION; PERSONNEL TRAINING, OIL SPILLS, CLEANUP, CONTINGENCY PLANNING, TEXAS,
0727 POLLUTION PREVENTION; PATENT, [illegible] TANKS, LEAKAGE, SOIL, STORAGE, DESIGN-ENGINEERING;
0730 POLLUTION PREVENTION; PETROLEUM PRODUCTS, OIL SPILLS, STORAGE, CONTINGENCY PLANNING; SOIL STORAGE PLAN,
0731 POLLUTION PREVENTION; OIL INDUSTRY, REFINING, SOURCES,
0735 POLLUTION PREVENTION; OIL SPILLS, [illegible] STORAGE, ENVIRONMENTAL EFFECTS,
0736 POLLUTION PREVENTION; OIL SPILLS, ENVIRONMENTAL PROTECTION, SHORELINES, [illegible]
0738 POLLUTION PREVENTION; OIL DISCHARGES, SHIPS, WASTE OIL TREATMENT, CLEANUP, MONITORING, IMCO,
0739 POLLUTION PREVENTION; OIL-WATER SEPARATION, OIL SPILLS, INTERNATIONAL CONVENTIONS, SHIPS, CONTINGENCY PLANNING, IMCO,
0746 POLLUTION PREVENTION; OIL SPILLS, CLEANUP, WASTE OIL DISPOSAL, [illegible] INDUSTRY,
0747 POLLUTION PREVENTION; PIPELINES, PATENT, LEAKAGE, SEALING MATERIAL,
0749 POLLUTION PREVENTION; PATENT, LUBRICATING OIL,
0754 POLLUTION PREVENTION; OIL SPILLS, RECOVERY, JAPAN, PORT FACILITIES,
0956 POLLUTION PREVENTION; INTERNATIONAL CONVENTIONS, IMCO, REGULATIONS, TANKERS,
0997 POLLUTION PREVENTION; INTERNATIONAL CONVENTIONS, IMCO, USCG,
1001 POLLUTION PREVENTION; OIL SPILLS, OFFSHORE DRILLING, BIBLIOGRAPHIES, LEGISLATION, US, INTERNATIONAL AGREEMENTS, OCEANS, SHIPS,
0802 POLYCHAETES, CONTAMINATION, SEDIMENTS, FUEL OIL, BIOLOGICAL EFFECTS, METABOLISM, FEEDING ACTIVITY, ARENICOLA MARINA,
0804 POLYCHAETES, HYDROCARBONS, UPTAKE, METABOLISM, RELEASE, SEDIMENTS, SEAWATER, NEANTHES ARENACEODENTATA,
0805 POLYCHAETES, HYDROCARBONS, FUEL OIL, BIOLOGICAL EFFECTS, UPTAKE, METABOLISM, NEANTHES ARENACEODENTATA,
0876 PORTS, PIPELINES, OIL SPILLS, OIL DISCHARGES, REFINERIES, WATER QUALITY, PETROLEUM FACILITIES,
0616 PORTS, OFFSHORE DEVELOPMENT, TANKERS, SOCIO-ECONOMIC EFFECTS, ENVIRONMENTAL EFFECTS, DEEPWATER TERMINALS,
0619 PORTS, OIL SPILLS, ENVIRONMENTAL EFFECTS, SOCIO-ECONOMIC EFFECTS, COASTS, DEEPWATER PORTS,
0642 PORTS, OIL TRANSFER, FLORIDA, MEXICO/GULF OF, ENVIRONMENTAL EFFECTS, SOCIO-ECONOMIC EFFECTS, LEGISLATION, DEEPWATER PORTS,
0655 PORTS, DEVELOPMENT, ENVIRONMENTAL PROTECTION, REGULATIONS, DESIGN-ENGINEERING,
0656 PORTS, PACIFIC OCEAN, OIL TRANSPORT, OIL SPILLS, STORAGE, SOCIAL EFFECTS, ENVIRONMENTAL EFFECTS, PALAU, SUPERPORT,
0666 PORTS, ONSHORE IMPACTS, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, SOCIO-ECONOMIC EFFECTS, REFINERIES, COASTS, FLORIDA, GUIDELINES,
0771 PORTS, OIL SPILLS, OFFSHORE DRILLING, MODELS, MOVEMENT, COASTS, NEW JERSEY, DELAWARE,
0946 PORTS, OIL TRANSFER, LEGISLATION, DELAWARE BAY,
0625 PORTUGAL, OIL SPILLS, ENVIRONMENTAL EFFECTS, HYDROCARBONS, CLEANUP, DISPERSANTS, SHORELINES,
0656 PRECIPITATION; OIL-WATER SEPARATION, EMULSIONS, FLOCCULATION, DESIGN-ENGINEERING,
0681 PRECIPITATION, PH CONTROL, PATENT, OIL-WATER SEPARATION, WASTEWATER TREATMENT, ABSORPTION,
0642 PRODUCTION, POLLUTION CONTROL, OIL INDUSTRY, REGULATIONS, ECONOMICS, REFINING, EXPLORATION,
0850 PRODUCTION, OIL SHALE, EXTRACTION, ENVIRONMENTAL EFFECTS, SOLID WASTES, WASTEWATERS,
0861 PRODUCTION, PLANTS, OIL SPILLS, EXPLORATION, ARCTIC, ENVIRONMENTAL EFFECTS, WILDLIFE, MARINE ORGANISMS,
0935 PRODUCTION, OIL INDUSTRY, GUIDELINES, EXTRACTION, WASTEWATERS, EPA, ONSHORE POINT SOURCE CATEGORY,
0976 PRODUCTION, POLLUTION CONTROL, OIL-WATER SEPARATION, GUIDELINES, WASTEWATER TREATMENT, STORAGE, DISTRIBUTION,
0797 PUERTO RICO, OIL SPILLS, BIOLOGICAL EFFECTS, CONTAMINATION, MARINE ORGANISMS, TROPICAL REGIONS, COASTS, MANGROVES, TURTLE GRASS,
0577 PUGET SOUND, OIL SPILLS, SKIMMERS, RECOVERY, DESIGN-ENGINEERING, US,
0580 PUGET SOUND, OIL TRANSPORT, TANKERS, REGULATIONS, LAW ENFORCEMENT, WASHINGTON,
0768 PUGET SOUND, CONTAMINATION, BIOLOGICAL EFFECTS,
0827 PUGET SOUND, CONTAMINATION, ENVIRONMENTAL EFFECTS,
0851 PUGET SOUND, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, MEXICO/GULF OF, FATE, HYDROCARBONS, TOXICITY, MARINE ORGANISMS, NOAA,
0689 RECLAMATION, PATENT, WASTE OIL, REFINING,
0707 RECLAMATION, PATENT, WASTE OIL, LUBRICATING OIL,
0708 RECLAMATION, WASTE OIL, CRUDE OIL,
0709 RECLAMATION, WASTE OIL, TREATMENT,
0870 RECOVERY, OIL SPILLS, CLEANUP, DISPOSAL, ECOSYSTEMS, ARCTIC,

[illegible] RECOVERY, PUGET SOUND, OIL SPILLS, SKIMMERS, DESIGN-ENGINEERING,
[illegible] RECOVERY, OIL SPILLS, BARGES, DESIGN-ENGINEERING, *CLEAN SWEEP,
[illegible] RECOVERY, OIL SPILLS, HARBORS, ESTUARIES, DESIGN-ENGINEERING, *CLEAN SWEEP,
[illegible] RECOVERY, OIL-WATER SEPARATION, OIL SLICKS, SKIMMERS,
[illegible] RECOVERY, PATENT, OIL SPILLS, CLEANUP, DESIGN-ENGINEERING, *OLEOPHILIC SPONGE,
[illegible] RECOVERY, OIL SPILLS, ABSORPTION, DESIGN-ENGINEERING,
[illegible] RECOVERY, PATENT, OIL SLICKS, DESIGN-ENGINEERING, *OLEOPHILIC CONTAINER,
[illegible] RECOVERY, OIL SPILLS, HYDROCARBONS, GROUNDWATER, CONTINGENCY PLANNING, COST ANALYSIS,
[illegible] RECOVERY, PATENT, OIL SLICKS, SKIMMERS, DESIGN-ENGINEERING,
[illegible] RECOVERY, PATENT, OIL SLICKS, SKIMMERS, DESIGN-ENGINEERING,
[illegible] RECOVERY, OIL-WATER SEPARATION, OIL SPILLS, BOOMS, SKIMMERS, DESIGN-ENGINEERING,
SORBENTS,
[illegible] RECOVERY, OIL SPILLS, SKIMMERS, DESIGN-ENGINEERING, USCG,
[illegible] RECOVERY, OIL SPILLS, SKIMMERS, BOOMS, STORAGE, BARGE,
[illegible] RECOVERY, OIL SPILLS, MODELS, CLEANUP, COST ANALYSIS,
[illegible] RECOVERY, OIL SPILLS, SKIMMERS, BOOMS, CONTAINMENT, DESIGN-ENGINEERING, USCG,
[illegible] RECOVERY, PATENT, OIL SLICKS, SKIMMERS, DESIGN-ENGINEERING,
[illegible] RECOVERY, OIL SPILLS, CONTAINMENT, DESIGN-ENGINEERING, *COLLECTION BARGE,
[illegible] RECOVERY, OIL SPILLS, ICE, DESIGN-ENGINEERING, ARCTIC, CANADA, *CLEAN SWEEP,
[illegible] RECOVERY, OIL SPILLS, SPILL CONTAINMENT, REMOTE SENSING, STORAGE, DISPOSAL,
[illegible] RECOVERY, OIL SPILLS, ABSORPTION, RIVERS, ESTUARIES, HARBORS, DESIGN-ENGINEERING, EPA,
SORBENTS,
[illegible] RECOVERY, OIL-WATER SEPARATION, OIL SPILLS, CRUDE OIL, FUEL OIL, SKIMMERS, CANADA,
[illegible] RECOVERY, OIL SPILLS, SKIMMERS, INVESTIGATION, CANADA,
[illegible] RECOVERY, OIL TANKS, LEAKAGE, ACCIDENTS, CONTAINMENT, GROUNDWATER,
[illegible] RECOVERY, OIL-WATER SEPARATION, OIL SPILLS, SKIMMERS, DESIGN-ENGINEERING,
[illegible] RECOVERY, OIL SPILLS, CONTAINMENT, SKIMMERS, BOOMS, EPA, SORBENTS,
[illegible] RECOVERY, PATENT, OIL SLICKS, SKIMMERS, DESIGN-ENGINEERING,
0714 RECOVERY, POLLUTION CONTROL, PERSONNEL TRAINING, OIL SPILLS, OIL INDUSTRY, CLEANUP,
RESTORATION,
0722 RECOVERY, POLLUTION CONTROL, OIL SPILLS, DETECTION, CONTAINMENT, DISPOSAL,
[illegible] RECOVERY, POLLUTION PREVENTION, OIL SPILLS, JAPAN, *TAR PARTICLES,
[illegible] RECOVERY, OIL SPILLS, ENVIRONMENTAL EFFECTS, BIODEGRADATION, SOURCES, CLEANUP, *PROGR
REVIEWS,
1004 RECOVERY, POLLUTION CONTROL, OIL-WATER SEPARATION, OIL SPILLS, BIBLIOGRAPHIES,
BALLAST, BILGES,
[illegible] RECYCLING, OIL INDUSTRY, ECONOMICS, WASTEWATERS, WASTE OIL, SOLID WASTES, DISPOSAL,
[illegible] RECYCLING, WASTE OIL, SLUDGE, DISPOSAL, BIOLOGICAL EFFECTS,
[illegible] RECYCLING, BIODEGRADATION, WASTEWATERS, REFINERIES,
[illegible] REFINERIES, HYDROCARBONS, SOURCES, DISTRIBUTION, INDUSTRIES, *MUNICIPAL DISCHARGES,
RUNOFF,
0476 REFINERIES, PORTS, PIPELINES, OIL SPILLS, OIL DISCHARGES, WATER QUALITY, *PETROLEUM
FACILITIES,
[illegible] REFINERIES, INDUSTRIES, DELAWARE, URBAN RUNOFF, OIL CONTENT, *DELAWARE ESTUARY,
[illegible] REFINERIES, OIL SLICKS, REMOTE SENSING, WASTEWATERS, MONITORING,
[illegible] REFINERIES, WASTEWATERS, ANALYTICAL METHODS, CHROMATOGRAPHY, SPECTROMETRY,
[illegible] REFINERIES, WASTEWATERS, HYDROCARBONS, DELAWARE, OIL CONTENT, *URBAN RUNOFF,
DELAWARE ESTUARY,
0555 REFINERIES, PETROLEUM PRODUCTS, TAR, CHEMICAL ANALYSIS, CHROMATOGRAPHY, WASTEWATERS,
LIQUID CHROMATOGRAPHY,
0561 REFINERIES, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, HYDROCARBONS, WASTEWATERS,
URBAN RUNOFF, REGULATIONS, DELAWARE,
[illegible] REFINERIES, OIL-WATER SEPARATION, WASTEWATER TREATMENT, BELGIUM,
[illegible] REFINERIES, POLLUTION PREVENTION, WASTEWATER TREATMENT, *SURFACE WATERS, BELGIUM,
[illegible] REFINERIES, WASTEWATER TREATMENT, DISPOSAL, CONSERVATION,
[illegible] REFINERIES, POLLUTION CONTROL, WASTEWATER TREATMENT, CONSERVATION, *WATER REUSE,
[illegible] REFINERIES, WASTEWATER TREATMENT, ACTIVATED SLUDGE, GUIDELINES,
[illegible] REFINERIES, WASTEWATER TREATMENT, CONTAMINANTS, *INTERMEDIATE TREATMENT,
[illegible] REFINERIES, WASTEWATER TREATMENT, BIOLOGICAL STABILIZATION,
[illegible] REFINERIES, WASTEWATER TREATMENT, CHEMICAL TREATMENT, *WATERBORNE COLLOIDS,
[illegible] REFINERIES, OIL-WATER SEPARATION, WASTEWATER TREATMENT, FILTRATION,
[illegible] REFINERIES, WASTEWATER TREATMENT, CONTAMINANTS, ACTIVATED SLUDGE, *BIOCHEMISTRY,
[illegible] REFINERIES, OIL-WATER SEPARATION, WASTEWATERS, EMULSIONS, FLOCCULATION,
[illegible] REFINERIES, OIL-WATER SEPARATION, WASTEWATER TREATMENT, WATER QUALITY, *ENERGY
REQUIREMENTS,
0709 REFINERIES, POLLUTION CONTROL, PLANTS, *NATURAL GAS MONITORING, WASTEWATERS, SOLID
WASTES,
0711 REFINERIES, POLLUTION CONTROL, OIL INDUSTRY, EPA,
0744 REFINERIES, AROMATIC HYDROCARBONS, WASTEWATERS, CONTAMINATION, MOLLUSKS, FOOD WEB,
*FOOD CHAIN ACCUMULATION, [illegible]-BENZOPYRENE,
[illegible] REFINERIES, WASTEWATERS, TOXICITY, FISH, *AQUATIC LIFE, CANADA,
[illegible] REFINERIES, WASTEWATERS, TOXICITY, FRESHWATER, FISH, INVERTEBRATES, *LETHAL
CONCENTRATION,
[illegible] REFINERIES, PORTS, ONSHORE IMPACTS, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS,

SOCIO-ECONOMIC EFFECTS, COASTS, FLORIDA, GUIDELINES,
[illegible] REFINERIES: [illegible] BIODEGRADATION, WASTEWATERS
[illegible] REFINERIES: [illegible] SURFACE MICROLAYER, COMPOSITION,
[illegible] REFINERIES: POLLUTION CONTROL, OIL INDUSTRY, LEGISLATION, [illegible]
[illegible] REFINERIES: OIL INDUSTRY, OUTFALLS, WASTEWATER TREATMENT, LEGISLATION, WATER
QUALITY, ECONOMICS
[illegible] REFINING: RECLAMATION, PATENT, WASTE OIL
[illegible] REFINING: POLLUTION PREVENTION, OIL INDUSTRY, SOURCES
[illegible] REFINING: PRODUCTION, POLLUTION CONTROL, OIL INDUSTRY; REGULATIONS, ECONOMICS,
EXPLORATION
[illegible] REGULATIONS: OIL SPILLS, TANKERS, TAR, ARGO MERCHANT SPILL, [illegible] TANKERS,
[illegible] REGULATIONS: OIL-GAS LEASING, OCS, MONITORING, COASTS, EIS, BLM, ENVIRONMENTAL
STUDIES PROGRAM
[illegible] REGULATIONS: [illegible] CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, HYDROCARBONS,
[illegible]
[illegible] REGULATIONS: PUGET SOUND, OIL TRANSPORT, TANKERS, LAW ENFORCEMENT, WASHINGTON
[illegible] REGULATIONS: POLLUTION PREVENTION, OIL TRANSFER, OIL DISCHARGES, STATISTICAL ANALYSIS,
USCG
[illegible] REGULATIONS, POLLUTION CONTROL, OIL TRANSPORT, OIL SPILLS, TANKERS, ECONOMICS,
STANDARDS
[illegible] REGULATIONS: OIL SPILLS, TANKERS, US, INTERNATIONAL AGREEMENTS
[illegible] REGULATIONS: [illegible] ENVIRONMENTAL PROTECTION, DESIGN-ENGINEERING,
[illegible] REGULATIONS: [illegible] ARGO MERCHANT SPILL, LAW ENFORCEMENT,
[illegible] REGULATIONS: POLLUTION CONTROL, ENVIRONMENTAL EFFECTS, LEGISLATION, US,
[illegible] REGULATIONS: REFINING, PRODUCTION, POLLUTION CONTROL, OIL INDUSTRY, ECONOMICS,
EXPLORATION
[illegible] REGULATIONS: OIL INDUSTRY, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, FISHERIES, US,
[illegible] REGULATIONS: OFFSHORE DRILLING, OFFSHORE DEVELOPMENT, ENVIRONMENTAL PROTECTION,
ALASKA, CALIFORNIA, [illegible]
[illegible] REGULATIONS: OFFSHORE DEVELOPMENT, ENVIRONMENTAL PROTECTION, ECONOMIC EFFECTS,
DELAWARE
[illegible] REGULATIONS: PETROLEUM PRODUCTS, CRUDE OIL, ENVIRONMENTAL EFFECTS, ECONOMIC EFFECTS,
[illegible] OIL IMPORT PROGRAM
[illegible] REGULATIONS: OIL TRANSFER, OIL DISCHARGES, US, SHIPS, BILGES, USCG
[illegible] REGULATIONS: [illegible] EUROPE,
[illegible] REGULATIONS: POLLUTION PREVENTION, INTERNATIONAL CONVENTIONS, [illegible] TANKERS,
[illegible] RELEASE: FISH, NAPHTHALENES, DISTRIBUTION, UPTAKE, [illegible] SPONDYLUS
[illegible]
[illegible] RELEASE: PLATFORMS, HYDROCARBONS, MOLLUSKS, UPTAKE, SEDIMENTS, TEXAS, TRINITY BAY,
[illegible]
[illegible] RELEASE: AROMATIC HYDROCARBONS, MOLLUSKS: UPTAKE, MODIOLUS DEMISSUS, CRASSOSTREA
VIRGINICA, [illegible]
[illegible] RELEASE: AROMATIC HYDROCARBONS, SEAWATER, MARINE ORGANISMS, UPTAKE,
[illegible] RELEASE: [illegible] HYDROCARBONS, UPTAKE, [illegible] SEDIMENTS, SEAWATER, [illegible]
[illegible]
[illegible] REMOTE SENSING: OIL SPILLS, MONITORING, SPREADING, MOVEMENT, ATLANTIC OCEAN, ARGO
MERCHANT SPILL
[illegible] REMOTE SENSING: OIL SPILLS, SHIPS, SURVEILLANCE, DESIGN-ENGINEERING, LAW ENFORCEMENT,
ENVIRONMENTAL PROTECTION, USCG
[illegible] REMOTE SENSING: [illegible] CONTAMINANTS, COASTS, EUROPE, [illegible] SATELLITE,
[illegible] REMOTE SENSING: OIL SLICKS: DETECTION, SURVEILLANCE, NATURAL SEEPAGE, SANTA BARBARA
CHANNEL
[illegible] REMOTE SENSING: POLLUTION CONTROL, OIL SPILLS, CLEANUP, LAW ENFORCEMENT, EPA,
[illegible] REMOTE SENSING: OIL SLICKS: DETECTION, SOURCE IDENTIFICATION, [illegible]
[illegible] REMOTE SENSING: OIL SLICKS: SPREADING, [illegible] DELAWARE BAY, DRIFT, SPREADING, MODELS,
[illegible] REMOTE SENSING: PLATFORMS, OIL SLICKS, DETECTION, NATURAL SEEPAGE, SANTA BARBARA
CHANNEL, [illegible] RADAR
[illegible] REMOTE SENSING: OIL SPILLS: DETECTION, SURVEILLANCE, USCG, AIRBORNE COASTAL PATROL,
[illegible] REMOTE SENSING: OIL SPILLS: DETECTION, [illegible] CONTAMINATION, [illegible]
[illegible]
[illegible] REMOTE SENSING: OIL SPILLS: BEAUFORT SEA, OPTICAL TECHNIQUES,
[illegible] REMOTE SENSING: [illegible] MONITORING,
[illegible] REMOTE SENSING: RECOVERY, [illegible] CONTAINMENT, STORAGE, DISPOSAL,
[illegible] RESTORATION: OIL SPILLS, CLEANUP, CANADA, [illegible] OIL SPILL
[illegible] RESTORATION: OIL SPILLS, [illegible] TOXICITY, SEDIMENTS,
[illegible] RESTORATION: OIL SPILLS, [illegible] CONTAMINATION, SOIL, [illegible]
[illegible] RESTORATION: OIL SPILLS, SOIL, VEGETATION, [illegible]
[illegible] RESTORATION: PLANTS, OIL SPILLS, SOIL, BIODEGRADATION, FERTILIZERS,
[illegible] RESTORATION: OIL SPILLS, SOILS, CANADA
[illegible] RESTORATION: OIL SPILLS, [illegible] SOLVENTS, DELAWARE, [illegible] SPILL,
[illegible] RESTORATION: RECOVERY, POLLUTION CONTROL, PERSONNEL TRAINING, OIL SPILLS, OIL
[illegible] CLEANUP
[illegible] RESTORATION: OIL SPILLS, BIOLOGICAL EFFECTS, MARINE ORGANISMS, SAN FRANCISCO BAY,
[illegible] RESTORATION: CONSERVATION, BIRDS, [illegible]
[illegible] RESTORATION: OIL SPILLS, FUEL OIL, BIOLOGICAL EFFECTS, STREAMS, INVERTEBRATES, FISH,

NEW MEXICO
[illegible] SEWAGE, REFINERIES, POLLUTION CONTROL, WASTEWATER TREATMENT, CONSERVATION, *WATER
[illegible] SHORE PROTECTION, WASTE OIL, DISPOSAL, BIOLOGICAL EFFECTS
[illegible] RHODE ISLAND, BIODEGRADATION, HYDROCARBONS, BACTERIA, SEDIMENTS, SEAWATER,
NARRAGANSETT BAY
[illegible] RIVERS, OIL SPILLS, WASTE OIL, ENVIRONMENTAL EFFECTS, VEGETATI[illegible]ENNSYLVANIA,
[illegible]
[illegible] RIVERS, OIL SLICKS, ESTUARIES, DESIGN-ENGINEERING, [illegible] OIL BOOMS,
[illegible] RIVERS, OIL SPILLS, CONTAINMENT, DESIGN-ENGINEERING, [illegible]
[illegible] RIVERS, OIL SPILLS, CONTAINMENT, BOOMS, CONTINGENCY PLANNING, CANADA, US, *DETROIT-ST. CLAIR RIVER SYSTEM
[illegible] RIVERS, RECOVERY, OIL SPILLS, ABSORPTION, ESTUARIES, HARBORS, DESIGN-ENGINEERING, EPA, SORBENTS
[illegible] RIVERS, TAR, HYDROCARBONS, FATE, ESTUARIES, ATLANTIC COAST, ADSORPTION, BIODEGRADATION,
[illegible] SAMPLING, TAR, MONITORING, COASTS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, CARCINOGENS, SPECTROMETRY, *COASTAL WATERS
[illegible] SAMPLING, MONITORING, CONTAMINANTS, OCEANS, HYDROCARBONS, TAR, ANALYTICAL TECHNIQUES, MARINE ORGANISMS
[illegible] SAMPLING, MONITORING, TAR, DISTRIBUTION, ATLANTIC OCEAN
[illegible] SAMPLING, PACIFIC OCEAN, HYDROCARBONS, CHEMICAL ANALYSIS, *TANKER ROUTES,
[illegible] SAMPLING, PACIFIC OCEAN, HYDROCARBONS, DISTRIBUTION, *TANKER ROUTES
[illegible] SAMPLING, HYDROCARBONS, SEDIMENTS, CHEMICAL ANALYSIS, SOURCES, DISTRIBUTION, MEXICO/GULF OF
[illegible] SAMPLING, BENTHOS, ESTUARIES, WATER QUALITY, ALGAE, EPIFAUNA
[illegible] SAMPLING, OFFSHORE DEVELOPMENT, HYDROCARBONS, DISTRIBUTION, MICROORGANISMS, BACTERIA, TAR, SEDIMENTS, NORTH SEA
[illegible] SAMPLING, HYDROCARBONS, *EXTRACTABLE ORGANICS, HARBORS, NEW YORK, CONTAMINATION, DISTRIBUTION
[illegible] SAMPLING, HYDROCARBONS, SEDIMENTS, BENTHOS, UPTAKE, CHEMICAL ANALYSIS, TAR, [illegible]
[illegible] SAMPLING, HYDROCARBONS, OCEANS, CHEMICAL ANALYSIS
[illegible] SAMPLING, HYDROCARBONS, SEDIMENTS, ALGAE, CHROMATOGRAPHY, MEXICO/GULF OF, MISSISSIPPI RIVER
[illegible] SAMPLING, OIL SPILLS, SOURCE IDENTIFICATION, ANALYTICAL TECHNIQUES, CHROMATOGRAPHY, SPECTROSCOPY, USCG
[illegible] SAMPLING, BIODEGRADATION, CRUDE OIL, BACTERIA, MONITORING, FATE,
[illegible] SAMPLING, OIL SPILLS, FATE, MOVEMENT, MONITORING, OCEANS, NOAA
[illegible] SAMPLING, REFINERIES, HYDROCARBONS, MEDITERRANEAN SEA, *SURFACE MICROLAYER COMPOSITION,
[illegible] SAN FRANCISCO BAY, RESTORATION, OIL SPILLS, BIOLOGICAL EFFECTS, MARINE ORGANISMS,
[illegible] SANTA BARBARA CHANNEL, REMOTE SENSING, OIL SLICKS, DETECTION, SURVEILLANCE, NATURAL SEEPAGE
[illegible] SANTA BARBARA CHANNEL, REMOTE SENSING, PLATFORMS, OIL SLICKS, DETECTION, NATURAL SEEPAGE, *SIDE LOOKING RADAR
[illegible] SANTA BARBARA CHANNEL, OIL SPILLS, CONTINGENCY PLANNING, FATE, ENVIRONMENTAL PROTECTION, [illegible]
[illegible] SANTA BARBARA CHANNEL, CRUDE OIL, NATURAL SEEPAGE, CHRONIC EFFECTS, MARINE ORGANISMS, MOLLUSKS
[illegible] SANTA BARBARA CHANNEL, PLATFORMS, OFFSHORE DRILLING, BIOLOGICAL EFFECTS, MARINE ORGANISMS
[illegible] SANTA BARBARA CHANNEL, OFFSHORE DRILLING, ENVIRONMENTAL EFFECTS, EIS, *AIR QUALITY IMPACTS
[illegible] SARGASSO SEA, SOURCE IDENTIFICATION, HYDROCARBONS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, SPECTROMETRY, DISTRIBUTION
[illegible] SCOTLAND, SOCIAL IMPACTS, OFFSHORE DEVELOPMENT, ECONOMIC EFFECTS,
[illegible] SCOTLAND, PIPELINES, OIL INDUSTRY, DEVELOPMENT, STORAGE, *SULLOM VOE TERMINAL,
[illegible] SCOTLAND, PLATFORMS, DEVELOPMENT, EIS, ENVIRONMENTAL EFFECTS,
[illegible] SEAWATER, HYDROCARBONS, CHEMICAL ANALYSIS, CHROMATOGRAPHY,
[illegible] SEAWATER, DISPERSANTS, CHEMICAL ANALYSIS, BIODEGRADATION,
[illegible] SEAWATER, OXIDATION, OIL SPILLS, CLEANUP, MOLLUSKS, *WATER PURIFICATION, *MUSSELS, MYTILUS EDULIS
[illegible] SEAWATER, RELEASE, AROMATIC HYDROCARBONS, MARINE ORGANISMS, UPTAKE
[illegible] SEAWATER, RELEASE, POLYCHAETES, HYDROCARBONS, UPTAKE, METABOLISM, SEDIMENTS, *NEANTHES ARENACEODENTATA
[illegible] SEAWATER, POLLUTION CONTROL, EXPLORATION
[illegible] SEAWATER, RHODE ISLAND, BIODEGRADATION, HYDROCARBONS, BACTERIA, SEDIMENTS, NARRAGANSETT BAY
[illegible] SEAWATER, BIODEGRADATION, HYDROCARBONS, MICROORGANISMS
[illegible] SEAWATER, BIODEGRADATION, HYDROCARBONS, BACTERIA, *ALKANES, *ORGANIC SUBSTANCES,
[illegible] SEDIMENTS, MONITORING, CRUDE OIL, DETECTION, CHROMATOGRAPHY, *OIL-IN-WATER, *BIOLOGICAL MATERIALS
[illegible] SEDIMENTS, MONITORING, HYDROCARBONS, CHEMICAL ANALYSIS, SOURCE IDENTIFICATION, CALIFORNIA/SOUTHERN
[illegible] SEDIMENTS, SAMPLING, HYDROCARBONS, CHEMICAL ANALYSIS, SOURCES, DISTRIBUTION, MEXICO/GULF OF
[illegible] SEDIMENTS, SAMPLING, OFFSHORE DEVELOPMENT, HYDROCARBONS, DISTRIBUTION, MICROORGANISMS,

BACTERIA, TAR, NORTH SEA
0525 SEDIMENTS, SAMPLING, HYDROCARBONS, BENTHOS, UPTAKE, CHEMICAL ANALYSIS, TAR, [illegible] DEPTHS
0529 SEDIMENTS, SAMPLING, HYDROCARBONS, ALGAE, CHROMATOGRAPHY, MEXICO/GULF OF, MISSISSIPPI RIVER
0546 SEDIMENTS, HYDROCARBONS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, SPECTROMETRY, INTERTIDAL ZONE, WATER ANALYSIS
0587 SEDIMENTS, DETECTION, HYDROCARBONS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, SOLVENTS, N-PARAFFINS
0580 SEDIMENTS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, SOURCES, HYDROCARBONS, DETECTION, LAKES, WASHINGTON
0772 SEDIMENTS, OIL SPILLS, ENVIRONMENTAL EFFECTS, CONTAMINATION, MARINE ORGANISMS, CONTAINMENT, CLEANUP, MAINE, [illegible] SPILL
0773 SEDIMENTS, CRUDE OIL, BIOLOGICAL EFFECTS, MARINE ORGANISMS, ECOSYSTEMS, ALASKA,
0778 SEDIMENTS, RELEASE, PLATFORMS, HYDROCARBONS, MOLLUSKS, UPTAKE, TEXAS, TRINITY BAY, [illegible]
0802 SEDIMENTS, POLYCHAETES, CONTAMINATION, FUEL OIL, BIOLOGICAL EFFECTS, METABOLISM, FEEDING ACTIVITY, ARENICOLA MARINA
0804 SEDIMENTS, SEAWATER, RELEASE, POLYCHAETES, HYDROCARBONS, UPTAKE, METABOLISM, NEANTHES ARENACEODENTATA
0808 SEDIMENTS, CRUDE OIL, BIOLOGICAL EFFECTS, MOLLUSKS, BEHAVIOR, CHEMICAL ANALYSIS, CLAM, MACOMA BALTHICA
0820 SEDIMENTS, DRILLING, CORALS, DRILL MUD, CLEARING RATES
0871 SEDIMENTS, OIL INDUSTRY, OFFSHORE PRODUCTION, ENVIRONMENTAL EFFECTS, HYDROCARBONS, MARINE ORGANISMS, LOUISIANA
0916 SEDIMENTS, SEAWATER, RHODE ISLAND, BIODEGRADATION, HYDROCARBONS, BACTERIA, NARRAGANSETT BAY
0931 SEDIMENTS, BIODEGRADATION, HYDROCARBONS, METABOLISM, MICROORGANISMS, MARINE ORGANISMS, BENTHOS
0937 SEDIMENTS, OIL SPILLS, BIODEGRADATION, BACTERIA, CHESAPEAKE BAY, COLGATE CREEK
0975 SEDIMENTS, HYDROCARBONS, FATE, CRUDE OIL, [illegible], ENVIRONMENTAL EFFECTS,
0976 SEDIMENTS, PLANKTON, OIL SPILLS, BEACHES, FATE, MOVEMENT, BIOLOGICAL EFFECTS, BENTHOS, [illegible]
0980 SEDIMENTS, FUEL OIL, [illegible], WEATHERING, HYDROCARBONS, METABOLISM, MOLLUSKS, CHEDABUCTO BAY
0981 SEDIMENTS, HYDROCARBONS, DISTRIBUTION, LAKES
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[illegible] SOURCES, HYDROCARBONS, OCEANS, NATURAL SEEPAGE, BIOGENIC HYDROCARBONS, INPUT
ESTIMATES,

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 WASHINGTON
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 ANALYTICAL TECHNIQUES, CHROMATOGRAPHY
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 MERCHANT SPILL
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 OIL, TANKERS, NATURAL SEEPAGE
0877 STATISTICAL ANALYSIS, OIL SPILLS, US, MODELS, GREAT LAKES , COASTS, DISCRIMINANT
 ANALYSIS
0558 STATISTICAL ANALYSIS, REGULATIONS, POLLUTION PREVENTION, OIL TRANSPORT, OIL DISCHARGES,
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0110 TEXAS; POLLUTION PREVENTION, PERSONNEL TRAINING, OIL SPILLS, CLEANUP, CONTINGENCY PLANNING,
[illegible] TEXAS; PERSONNEL TRAINING, OIL SPILLS, *SPILL CONTROL COURSE,
[illegible] TEXAS; SEDIMENTS, RELEASE, PLATFORMS, HYDROCARBONS, MOLLUSKS, UPTAKE, *TRINITY BAY, [illegible] CLAM, *RANGIA CUNEATA,
[illegible] TOXICITY; OIL SPILLS, DISPERSANTS, CLEANUP, BIODEGRADATION,
[illegible] TOXICITY; OIL SPILLS, DISPERSANTS, CLEANUP, UK,
[illegible] TOXICITY; [illegible] OIL SPILLS, WILDLIFE, INVERTEBRATES,
[illegible] TOXICITY; FUEL OIL, [illegible] *LARVAL STAGES,
[illegible] TOXICITY; CRUDE OIL, CRUSTACEANS, ALASKA, WATER SOLUBLE FRACTIONS, [illegible]
[illegible] TOXICITY; CRUDE OIL, CRUSTACEANS, *WATER-SOLUBLE FRACTIONS, *CANCER MAGISTER DANA,
[illegible] TOXICITY; [illegible]
[illegible] TOXICITY; [illegible] MARINE ORGANISMS, ECOSYSTEMS,
[illegible] TOXICITY; [illegible]
[illegible] TOXICITY; [illegible] FRESHWATER, FISH, INVERTEBRATES, *LETHAL CONCENTRATION,
[illegible] TOXICITY; PETROLEUM PRODUCTS, HYDROCARBONS,
[illegible] TOXICITY; PETROLEUM PRODUCTS, AROMATIC HYDROCARBONS, MARINE ORGANISMS, *SUBLETHAL EFFECTS, [illegible]
[illegible] TOXICITY; CRUDE OIL, FUEL OIL, MARINE ORGANISMS, ALASKA, FISH, INVERTEBRATES,
[illegible] TOXICITY; [illegible] MARINE ORGANISMS, [illegible] RELEASE, ULTRA-VIOLET RADIATION,
[illegible] TOXICITY; CRUDE OIL, *NAPHTHALENE, FRESHWATER, ALGAE, METABOLISM, [illegible]
[illegible] TOXICITY; FACTORS, OIL SPILLS, MARINE ORGANISMS, *ZOOPLANKTON,
[illegible] TOXICITY; [illegible] OIL CO.,
[illegible] TOXICITY; [illegible]
[illegible] TOXICITY; [illegible] ENVIRONMENTAL EFFECTS, CONTAMINATION, MARINE ORGANISMS,
[illegible] TOXICITY; [illegible] OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, MEXICO/GULF OF,
[illegible] [illegible] HYDROCARBONS, [illegible] API,
[illegible] [illegible] MARINE ORGANISMS, INTERTIDAL ZONE,
[illegible] TROPICAL REGIONS, OIL SPILLS, BIOLOGICAL EFFECTS, MARINE ORGANISMS, [illegible]
[illegible] TROPICAL [illegible] FUEL OIL, BIOLOGICAL EFFECTS, MALAYSIA, *RIZOPHORA MANGROVE, [illegible]
[illegible] TROPICAL REGIONS, PUERTO RICO, OIL SPILLS, BIOLOGICAL EFFECTS, CONTAMINATION, MARINE ORGANISMS, COASTS, [illegible] *TURTLE GRASS,
[illegible] UK; CONTAMINATION, BIRDS, COASTS, MORTALITY,
[illegible] UK; OFFSHORE DEVELOPMENT, LIABILITY, *EUROPE, FRANCE, DENMARK, NORWAY, *POLLUTION DAMAGE,
[illegible] UPTAKE; [illegible] SEDIMENTS, SAMPLING, HYDROCARBONS, METHODS, CHEMICAL ANALYSIS, *NATURAL [illegible]
[illegible] UPTAKE; RELEASE, FISH, *NAPHTHALENES, DISTRIBUTION, *STRESS BEHAVIOR, *FUNDULUS [illegible]
[illegible] UPTAKE; [illegible] SEDIMENTS, RELEASE, PLATFORMS, HYDROCARBONS, MOLLUSKS, *TRINITY BAY, [illegible] *RANGIA CUNEATA,
[illegible] UPTAKE; [illegible] AROMATIC HYDROCARBONS, MOLLUSKS, *MODIOLUS DEMISSUS, *CRASSOSTREA VIRGINICA, [illegible]
[illegible] UPTAKE; [illegible] RELEASE, AROMATIC HYDROCARBONS, MARINE ORGANISMS,
[illegible] UPTAKE; [illegible] POLYCHAETES, HYDROCARBONS, METABOLISM, *NEANTHES [illegible]
[illegible] UPTAKE; POLYCHAETA, HYDROCARBONS, FUEL OIL, BIOLOGICAL EFFECTS, METABOLISM, *NEANTHES ARENACEODENTATA,
[illegible] US; STATISTICS, OIL DISCHARGES, INFORMATION SYSTEMS,
[illegible] US; STATISTICAL ANALYSIS, OIL SPILLS, MODELS, GREAT LAKES , COASTS, *DISCRIMINANT ANALYSIS,
[illegible] US; SOURCES, OIL DISCHARGES, USCG, *CAUSES,
[illegible] US; RIVERS, OIL SPILLS, CONTAINMENT, BOOMS, CONTINGENCY PLANNING, CANADA, *DETROIT-ST. CLAIR RIVER SYSTEM,
[illegible] US; [illegible] REGULATIONS, OIL SPILLS, INTERNATIONAL AGREEMENTS,
[illegible] US; [illegible] CANADA,
[illegible] US; REGULATIONS, POLLUTION CONTROL, ENVIRONMENTAL EFFECTS, LEGISLATION,
[illegible] US; REGULATIONS, OIL INDUSTRY, OFFSHORE DEVELOPMENT, ENVIRONMENTAL EFFECTS, [illegible]
[illegible] US; POLLUTION CONTROL, OFFSHORE DEVELOPMENT, OCS, LEGISLATION, ENVIRONMENTAL EFFECTS, ECONOMICS, DELAWARE,
[illegible] US; REFINERIES, POLLUTION CONTROL, OIL INDUSTRY, LEGISLATION, ECONOMIC EFFECTS,
[illegible] US; OIL SPILLS, LEGISLATION, LIABILITY, COMPENSATION, *SUPER-FUND,

0922 UK; SHIPS, REGULATIONS, OIL TRANSFER, OIL DISCHARGES, BILGES, USCG,
1001 UK; SHIPS, POLLUTION PREVENTION, OIL SPILLS, OFFSHORE DRILLING, BIBLIOGRAPHIES, LEGISLATION, INTERNATIONAL AGREEMENTS, OCEANS,
0373 USCG; POLLUTION PREVENTION, OIL SPILLS, CLEANUP, BIRDS, WILDLIFE, CHESAPEAKE BAY,
0481 USCG; OIL SOURCES, OIL DISCHARGES, TANKERS,
0483 USCG; SHIPS, MONITORING, DETECTION, DESIGN-ENGINEERING, OIL-IN-WATER,
0501 USCG; SURVEILLANCE, POLLUTION CONTROL, OIL SPILLS, MONITORING, HYDROCARBONS, GOVERNMENT AGENCIES, EPA, USGS, DOD
0505 USCG; SURVEILLANCE, SHIPS, REMOTE SENSING, OIL SPILLS, DESIGN-ENGINEERING, LAW ENFORCEMENT, ENVIRONMENTAL PROTECTION,
0515 USCG; SANTA BARBARA CHANNEL, REMOTE SENSING, PLATFORMS, OIL SLICKS, DETECTION, NATURAL SEEPAGE, SIDE-LOOKING RADAR
0516 USCG; SURVEILLANCE, REMOTE SENSING, OIL SPILLS, DETECTION, AIRBORNE COASTAL PATROL,
0565 USCG; SPECTROSCOPY, SOURCE IDENTIFICATION, SAMPLING, OIL SPILLS, ANALYTICAL TECHNIQUES, CHROMATOGRAPHY
0567 USCG; SOURCE IDENTIFICATION, POLLUTION PREVENTION, OIL TRANSPORT, OIL SPILLS, ANALYTICAL TECHNIQUES,
0580 USCG; SKIMMERS, OIL SPILLS, CLEANUP, ARGO MERCHANT SPILL,
0600 USCG; SKIMMERS, RECOVERY, OIL SPILLS, DESIGN-ENGINEERING,
0606 USCG; SKIMMERS, RECOVERY, OIL SPILLS, BOOMS, CONTAINMENT, DESIGN-ENGINEERING,
0658 USCG; STATISTICAL ANALYSIS, REGULATIONS, POLLUTION PREVENTION, OIL TRANSFER, OIL DISCHARGES,
0711 USCG; POLLUTION CONTROL, PERSONNEL TRAINING, OIL SPILLS, CONTINGENCY PLANNING, AIR/SUPPORT EXERCISE,
0742 USCG; POLLUTION CONTROL, OIL SPILLS, CLEANUP, DESIGN-ENGINEERING, EQUIPMENT DELIVERY SYSTEM,
0922 USCG; UK, SHIPS, REGULATIONS, OIL TRANSFER, OIL DISCHARGES, BILGES,
0997 USCG; POLLUTION PREVENTION, INTERNATIONAL CONVENTIONS, IMCO,
0501 USGS; USCG, SURVEILLANCE, POLLUTION CONTROL, OIL SPILLS, MONITORING, HYDROCARBONS, GOVERNMENT AGENCIES, EPA, DOD
0506 USN; SHIPS, OIL DISCHARGES, MONITORING, WASTEWATERS, DESIGN-ENGINEERING, OIL CONTENT,
0609 USN; SKIMMERS, OIL SPILLS, CLEANUP, HARBORS, SORBENT HANDLING SYSTEM,
0627 USN; SURFACTANTS, SKIMMERS, OIL SPILLS, CLEANUP, BOOMS, ABSORPTION, DESIGN-ENGINEERING,
0701 USN; SHIPS, OIL-WATER SEPARATION, BILGES, DESIGN-ENGINEERING,
0704 USN; STORAGE, PETROCHEMICALS, DISPOSAL, WASTE OIL, MANUALS,
0738 USN; SHIPS, POLLUTION PREVENTION, OIL DISCHARGES, WASTE OIL TREATMENT, CLEANUP, MONITORING,
0813 USN; PLANTS, OIL SPILLS, ARCTIC, ANIMALS,
0840 USSR; PETROLEUM PRODUCTS, BIODEGRADATION, CRUDE OIL, BACTERIA, CASPIAN SEA,
0842 USSR; PETROLEUM PRODUCTS, BIODEGRADATION, MICROORGANISMS, HYDROCARBONS, CRUDE OIL, GROUNDWATER
0466 VEGETATION, RIVERS, OIL SPILLS, WASTE OIL, ENVIRONMENTAL EFFECTS, PENNSYLVANIA, SCHUYLKILL SPILL,
0632 VEGETATION, SOIL, RESTORATION, OIL SPILLS, SORBENTS,
0656 VEGETATION, TEXAS, STORAGE, OIL SPILLS, CRUDE OIL, ENVIRONMENTAL EFFECTS, GROUNDWATER, LOUISIANA, SALT DOMES
0776 VEGETATION, OIL SPILLS, CRUDE OIL, BIOLOGICAL EFFECTS, ARCTIC, CANADA,
0780 VEGETATION, TOXICITY, SUBARCTIC REGIONS, CRUDE OIL, ALGAE, LAKES
0782 VEGETATION, SOIL, OIL SPILLS, BIOLOGICAL EFFECTS, MICROORGANISMS, CANADA,
0460 WASHINGTON, SOURCES, SEDIMENTS, CHEMICAL ANALYSIS, CHROMATOGRAPHY, HYDROCARBONS, DETECTION, LAKES,
0620 WASHINGTON, TANKERS, REGULATIONS, PUGET SOUND, OIL TRANSPORT, LAW ENFORCEMENT,
0466 WASTE OIL, VEGETATION, RIVERS, OIL SPILLS, ENVIRONMENTAL EFFECTS, PENNSYLVANIA, SCHUYLKILL SPILL,
0468 WASTE OIL, TANKERS, STATISTICAL ANALYSIS, SOURCES, OIL DISCHARGES, OIL INPUT, OCEANS, CRUDE OIL, NATURAL SEEPAGE,
0613 WASTE OIL; PATENT, CLEANUP, ABSORPTION,
0647 WASTE OIL; SOLID WASTES, RECYCLING, OIL INDUSTRY, ECONOMICS, WASTEWATERS, DISPOSAL,
0670 WASTE OIL; PATENT, OIL SPILLS, CLEANUP, ABSORPTION, METALLURGICAL [illegible],
0681 WASTE OIL; REFINING, RECLAMATION, PATENT,
0699 WASTE OIL; PATENT, WASTEWATER TREATMENT, EMULSIONS,
0704 WASTE OIL; USN, STORAGE, PETROCHEMICALS, DISPOSAL, MANUALS,
0706 WASTE OIL; REUSE, RECYCLING, DISPOSAL, BIOLOGICAL EFFECTS,
0707 WASTE OIL; RECLAMATION, PATENT, LUBRICATING OIL,
0708 WASTE OIL; RECLAMATION, CRUDE OIL,
0760 WASTE OIL; TOXICITY, FUEL OIL, CRUDE OIL, METABOLISM, BENTHOS, ALGAE,
0807 WASTE OIL; PATENT, OIL SPILLS, BIODEGRADATION, MICROORGANISMS, AFRICA/SOUTH,
0818 WASTE OIL; SOILS, OIL WELLS, BIODEGRADATION, BACTERIA, PETROLEUM WASTE,
0657 WASTE OIL; DISPOSAL, SOLID WASTES, INCINERATION, LIQUID WASTES,
0796 WASTE OIL; DISPOSAL, POLLUTION PREVENTION, OIL SPILLS, CLEANUP, FOREST INDUSTRY,
0703 WASTE OIL; TREATMENT, PATENT, ABSORPTION,
0709 WASTE OIL; TREATMENT, RECLAMATION,
0738 WASTE OIL; TREATMENT, USN, SHIPS, POLLUTION PREVENTION, OIL DISCHARGES, CLEANUP, MONITORING,
0488 WASTEWATERS, MONITORING, DETECTION, ANALYTICAL TECHNIQUES, LIGHT SCATTERING,

*PARTICULATES, *OIL-IN-WATER
[illegible] WASTEWATERS: PATENT, OIL-WATER SEPARATION, MONITORING,
[illegible] WASTEWATERS: MONITORING, DETECTION, CHEMICAL ANALYSIS,
[illegible] WASTEWATERS: PIPELINES, PATENT, OIL SLICKS, MONITORING, LEAKAGE, DETECTION,
  DESIGN-ENGINEERING
[illegible] WASTEWATERS: USA, SHIPS, OIL DISCHARGES, MONITORING, DESIGN-ENGINEERING, *OIL CONTENT,
[illegible] WASTEWATERS: SHIPS, PATENT, OIL-WATER SEPARATION, MONITORING, BILGES,
[illegible] WASTEWATERS: REMOTE SENSING, [illegible], OIL SLICKS, MONITORING
[illegible] WASTEWATERS: SPECTROMETRY, REFINERIES, ANALYTICAL TECHNIQUES, CHROMATOGRAPHY,
[illegible] WASTEWATERS: PETROLEUM PRODUCTS, PETROCHEMICALS, CHEMICAL ANALYSIS, CHROMATOGRAPHY,
  CONTAMINANTS, *GAS CHROMATOGRAPHY
[illegible] WASTEWATERS: PETROLEUM PRODUCTS, PETROCHEMICALS, CHEMICAL ANALYSIS, CHROMATOGRAPHY,
  HYDROCARBONS, FUELS
[illegible] WASTEWATERS: CHEMICAL ANALYSIS, CHROMATOGRAPHY, CONTAMINANTS, HYDROCARBONS, *LIQUID
  CHROMATOGRAPHY
[illegible] WASTEWATERS: REFINERIES, HYDROCARBONS, DELAWARE, *OIL CONTENT, *URBAN RUNOFF,
  *DELAWARE ESTUARY
[illegible] WASTEWATERS: PETROLEUM PRODUCTS, CHEMICAL ANALYSIS, MONITORING,
[illegible] WASTEWATERS: REFINERIES, PETROLEUM PRODUCTS, TAR, CHEMICAL ANALYSIS, CHROMATOGRAPHY,
  *LIQUID CHROMATOGRAPHY
[illegible] WASTEWATERS: CHEMICAL ANALYSIS, CONTAMINANTS, *SOLVENT EXTRACTION, *IR
  SPECTROPHOTOMETRY
[illegible] WASTEWATERS: SOURCE IDENTIFICATION, REGULATIONS, REFINERIES, CHEMICAL ANALYSIS,
  HYDROCARBONS, *SEWAGE, *URBAN RUNOFF, DELAWARE
[illegible] WASTEWATERS: WASTE OIL, SOLID WASTES, RECYCLING, OIL INDUSTRY, ECONOMICS, DISPOSAL,
[illegible] WASTEWATERS: REFINERIES, OIL-WATER SEPARATION, EMULSIONS, FLOCCULATION,
[illegible] WASTEWATERS: SOLID WASTES, REFINERIES, POLLUTION CONTROL, PLANTS, *NATURAL GAS
  MONITORING
[illegible] WASTEWATERS: REFINERIES, AROMATIC HYDROCARBONS, CONTAMINATION, MOLLUSKS, FOOD WEB,
  *FOOD CHAIN ACCUMULATION, [illegible]
[illegible] WASTEWATERS: TOXICITY, REFINERIES, FISH, AQUATIC LIFE, CANADA,
[illegible] WASTEWATERS: TOXICITY, REFINERIES, FRESHWATER, FISH, INVERTEBRATES, *LETHAL
  CONCENTRATION
[illegible] WASTEWATERS: SOLID WASTES, PRODUCTION, OIL SHALE, EXTRACTION, ENVIRONMENTAL EFFECTS,
[illegible] WASTEWATERS: REFINERIES, RECYCLING, *[illegible]
[illegible] WASTEWATERS: REGULATIONS, PIPELINES, OIL INDUSTRY, GUIDELINES, EUROPE,
[illegible] WASTEWATERS: GUIDELINES, PRODUCTION, EXPLORATION, DRILLING, EPA, *ONSHORE POINT
  SOURCE CATEGORY
[illegible] WASTEWATERS: PRODUCTION, OIL INDUSTRY, GUIDELINES, EXTRACTION, EPA, *ONSHORE POINT
  SOURCE CATEGORY
[illegible] WASTEWATER TREATMENT: TANKERS, OIL DISCHARGES, *SLOP TANK,
[illegible] WASTEWATER TREATMENT: REFINERIES, OIL-WATER SEPARATION, BELGIUM,
[illegible] WASTEWATER TREATMENT: REFINERIES, POLLUTION CONTROL, SURFACE WATERS, BELGIUM,
[illegible] WASTEWATER TREATMENT: PATENT, OIL-WATER SEPARATION, CONTAMINANTS, COALESCERS,
  DESIGN-ENGINEERING,
[illegible] WASTEWATER TREATMENT: OIL-WATER SEPARATION, FILTRATION, FLOTATION,
[illegible] WASTEWATER TREATMENT: REFINERIES, DISPOSAL, [illegible]
[illegible] WASTEWATER TREATMENT: CONTAMINANTS, FLOCCULATION, [illegible], *POLYELECTROLYTES,
[illegible] WASTEWATER TREATMENT: PATENT, OIL-WATER SEPARATION, BALLAST, COALESCERS,
[illegible] WASTEWATER TREATMENT: [illegible], REFINERIES, POLLUTION CONTROL, [illegible],
[illegible] WASTEWATER TREATMENT: REFINERIES, ACTIVATED SLUDGE, GUIDELINES,
[illegible] WASTEWATER TREATMENT: REFINERIES, CONTAMINANTS, [illegible] TREATMENT,
[illegible] WASTEWATER TREATMENT: REFINERIES, [illegible]
[illegible] WASTEWATER TREATMENT: REFINERIES, CHEMICAL TREATMENT, *HYDROUS [illegible] COLLOIDS,
[illegible] WASTEWATER TREATMENT: REFINERIES, OIL-WATER SEPARATION, FILTRATION,
[illegible] WASTEWATER TREATMENT: REFINERIES, CONTAMINANTS, ACTIVATED SLUDGE, *BIOCHEMISTRY,
[illegible] WASTEWATER TREATMENT: OIL-WATER SEPARATION, BILGES, FILTRATION, *TUBULAR
  ULTRAFILTRATION SYSTEM
[illegible] WASTEWATER TREATMENT: PRECIPITATION, PH CONTROL, PATENT, OIL-WATER SEPARATION,
  ADSORPTION
[illegible] WASTEWATER TREATMENT: INDUSTRIES,
[illegible] WASTEWATER TREATMENT: PATENT, OIL-WATER SEPARATION, ADSORPTION, [illegible],
[illegible] WASTEWATER TREATMENT: PETROCHEMICALS, ECONOMICS, LEGISLATION, [illegible],
[illegible] WASTEWATER TREATMENT: PATENT, OIL-WATER SEPARATION, COALESCERS, DESIGN-ENGINEERING,
[illegible] WASTEWATER TREATMENT: PETROCHEMICALS,
[illegible] WASTEWATER TREATMENT: PATENT, OIL-WATER SEPARATION, COALESCENCE, FLOTATION,
  DESIGN-ENGINEERING,
[illegible] WASTEWATER TREATMENT: OIL-WATER SEPARATION, ADSORPTION, [illegible],
[illegible] WASTEWATER TREATMENT: HYDROCARBONS, CONTAMINANTS, *VACUUM STRIPPING,
[illegible] WASTEWATER TREATMENT: PATENT, OIL-WATER SEPARATION, EMULSIONS, COAGULATION,
[illegible] WASTEWATER TREATMENT: PATENT, OIL-WATER SEPARATION, DESIGN-ENGINEERING,
[illegible] WASTEWATER TREATMENT: TANKERS, BALLAST, MOLLUSKS, *MYTILUS GALLOPROVINCIALIS,
[illegible] WASTEWATER TREATMENT: WASTE OIL, PATENT, EMULSIONS,
[illegible] WASTEWATER TREATMENT: PETROLEUM PRODUCTS, PATENT,
[illegible] WASTEWATER TREATMENT: PATENT, EXTRACTION, CONTAMINANTS, DESIGN-ENGINEERING,

0899 WASTEWATER TREATMENT, REFINERIES, OIL-WATER SEPARATION, WATER QUALITY, *ENERGY REQUIREMENTS,
0100 WASTEWATER TREATMENT, PATENT, OIL-WATER SEPARATION, FLOTATION,
0102 WASTEWATER TREATMENT, PATENT, OIL-WATER SEPARATION, ADSORPTION,
0906 WASTEWATER TREATMENT, STORAGE, PRODUCTION, POLLUTION CONTROL, OIL-WATER SEPARATION, GUIDELINES, DISTRIBUTION,
0997 WASTEWATER TREATMENT, REFINERIES, OIL INDUSTRY, GUIDELINES, LEGISLATION, WATER QUALITY, ECONOMICS,
0876 WATER QUALITY, REFINERIES, PORTS, PIPELINES, OIL SPILLS, OIL DISCHARGES, *PETROLEUM FACILITIES,
0921 WATER QUALITY, MONITORING, HYDROCARBONS, DISTRIBUTION, BEAUFORT SEA,
0923 WATER QUALITY, SAMPLING, BENTHOS, ESTUARIES, ALASKA, *EPIFAUNA,
0956 WATER QUALITY, DRILLING, ANALYTICAL TECHNIQUES, *DRILLING MUDS,
0899 WATER QUALITY, WASTEWATER TREATMENT, REFINERIES, OIL-WATER SEPARATION, *ENERGY REQUIREMENTS,
0951 WATER QUALITY, OIL SPILLS, OFFSHORE DEVELOPMENT, OCS, EPA, ENVIRONMENTAL MANAGEMENT, ESTUARIES, COASTS,
0997 WATER QUALITY, WASTEWATER TREATMENT, REFINERIES, OIL INDUSTRY, GUIDELINES, LEGISLATION, ECONOMICS,
0930 WEATHERING, OIL SPILLS, ESTUARIES, CHEMICAL ANALYSIS, FISH, FATE, HYDROCARBONS, *FUNDULUS HETEROCLITUS,
0758 WEATHERING, PLANKTON, OIL SPILLS, ESTUARIES, BIOLOGICAL EFFECTS, FISH, BENTHOS, ATLANTIC COAST,
0952 WEATHERING, STATISTICAL ANALYSIS, PIPELINES, OIL SPILLS, BEHAVIOR, CANADA, INLAND,
0955 WEATHERING, OIL SPILLS, MODELS, EVAPORATION,
0959 WEATHERING, SPREADING, OIL SPILLS, CRUDE OIL, CLEANUP, DISPERSANTS, EMULSIFICATION,
0974 WEATHERING, TAR, SOLUTION, OIL SPILLS, FATE, ARCTIC, CRUDE OIL, EVAPORATION, EMULSIFICATION,
0975 WEATHERING, TAR, SOLUTION, OIL SPILLS, CRUDE OIL, EVAPORATION, *SULFUR COMPOUNDS,
0980 WEATHERING, SEDIMENTS, FUEL OIL, FATE, HYDROCARBONS, METABOLISM, MOLLUSKS, CHEDABUCTO BAY,
0876 WILDLIFE, USCG, POLLUTION PREVENTION, OIL SPILLS, CLEANUP, BIRDS, CHESAPEAKE BAY,
0830 WILDLIFE, TOXICITY, SOLVENTS, RESTORATION, OIL SPILLS, *DETERGENTS,
0824 WILDLIFE, TANKERS, OIL SPILLS, FATE, ENVIRONMENTAL EFFECTS, MODELS, ECONOMIC EFFECTS, *WORLD WAR II SPILLS,
0839 WILDLIFE, OIL SHALE, DEVELOPMENT, BIOLOGICAL EFFECTS, FISH, *US FISH & WILDLIFE SERVICE,
0901 WILDLIFE, PRODUCTION, PLANTS, OIL SPILLS, EXPLORATION, ARCTIC, ENVIRONMENTAL EFFECTS, MARINE ORGANISMS,
0989 WILDLIFE, OIL SPILLS, ENVIRONMENTAL DETERIORATION, COMPENSATION, MARINE ORGANISMS, ECONOMICS, *LEGAL ASPECTS,
0957 YEASTS, TOXICITY, OXIDATION, FUEL OIL, *HYDROPEROXIDES,
0533 ZOOPLANKTON, SOURCES, HYDROCARBONS, CHEMICAL ANALYSIS, DISTRIBUTION, MEXICO/GULF OF, *BIOGENIC HYDROCARBONS,

AUTHOR INDEX

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COMMISSION EUROPEAN COMM.
CONCAWE SECRETARIAT
[illegible]
ENVIRONMENTAL CONSULTANTS
[illegible]

[illegible]

[illegible]	[illegible]
U.S. FISH & WILDLIFE SERVICE	[illegible]
[illegible]	[illegible]
USN SUPPLY SYSTEMS COMMAND	[illegible]
[illegible]	[illegible]

[illegible]	[illegible]
[illegible] CONSULTANTS	[illegible]
[illegible]	[illegible]

APPENDIX

Periodicals Reviewed

Abstracts on Health Effects of Environmental Pollutants
Alaska Seas and Coasts
Alternatives: Perspectives on Society and Environment
Ambio
American Fisheries Society Transactions
Applied Energy
Applied Microbiology
Applied Science & Technology Index
Aquatic Sciences & Fisheries Abstracts
Audubon
Australian Science Index
Berichte der Deutschen Wissenschaftlichen Kommission fuer Meeresforschung
Biological Abstracts
Bioscience
British Birds
Bulletin of Environmental Contamination and Toxicology
California Water Pollution Control Association Bulletin
Chemical Abstracts
Chemical and Engineering News
Chemical Engineering
Chemical Engineering Progress
Chemical Week
Chemistry in Canada
Chemosphere
Current Contents: Life Sciences
Current Contents: Physical and Chemical Sciences
Deep-Sea Research
Ecolibrium
Ecological Abstracts
Ecological Modelling
Ecological Society of America Bulletin
Ecology Law Quarterly
Energy Information Abstracts
Energy Review
Environment
Environment Abstracts
Environmental Action
Environmental Conservation
Environmental Geology
Environmental Health and Pollution Control

Environmental Periodicals Bibliography
Environmental Pollution
Environmental Science & Technology
Environmental Technology and Economics
EPA Reports Bibliography Quarterly
Erdoel und Kohle Erdgas Petrochemie vereinigt mit Brennstoffchemie
Estuarine and Coastal Marine Science
Fuel Abstracts and Current Titles
Government Reports Announcements
Hydrocarbon Processing
IMS Newsletter
India Journal of Environmental Health
Industrial Wastes Information Bulletin
International Aerospace Abstracts
International Journal of Ecology and Environmental Science
International Journal of Environmental Analytical Chemistry
International Petroleum Abstracts
Iranian Journal of Science and Technology
Journal of Canadian Petroleum Technology
Journal of Chromatography
Journal of Environmental Science and Health
Journal of Environmental Sciences
Journal of Petroleum Technology
Journal of the Fisheries Research Board of Canada
Journal of Toxicology and Environmental Health
Limnology and Oceanography
Marine Biological Association of the United Kingdom, Journal
Marine Biology
Marine Chemistry
Marine Fisheries Review
Marine Geology
Marine Geotechnology
Marine Newsletter
Marine Pollution Bulletin
Marine Science Contents Tables
Marine Technology Society, Journal
Maritime Research Information Service Abstracts
Massachusetts Audubon
Microbial Ecology
National Fisherman
National Petroleum News
National Research Council, News Report
National Wildlife
Nature
New Technical Books
Nippon Susan Gakkai Shi. Bulletin of the Japanese Society of
  Scientific Fisheries
Ocean Engineering
Ocean Industry
Ocean Management
Ocean Oil Weekly Report
Oceanic Abstracts

Oceanus
Offshore
Offshore Abstracts
Oil and Gas Journal
Outdoor California
Pacific Oil World
Petroleum Abstracts
Petroleum Engineer International
Petroleum Today
Pollution Abstracts
Pollution Engineering
Proceedings in Print
Resources
Resource Recovery and Conservation
Royal Society of London, Proceedings, Series B, Biological Sciences
Science
Science News
Science of the Total Environment
Scientific and Technical Aerospace Reports
Sea Frontiers
Sea Secrets
Sea Technology
Selected References on Environmental Quality
Selected Water Resources Abstracts
Sierra Club, San Francisco, Bulletin
Technical Book Review
The Ecologist
The Engineering Index
The International Journal of Environmental Studies
The Sciences
UDS Water Quality Control Digest
Underwater Information Bulletin
Underwater Naturalist
Water, Air, and Soil Pollution
Water Pollution Control
Water Pollution Control Federation, Journal
Water Research
WRC Information
Western Fisheries

U.S. Environmental Protection Agency
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Edison, New Jersey 08817

We are requesting your assistance upon receiving the report ("Oil Spill and Oil Pollution Reports, November 1976 - April 1977").

Is the information usable?
Is the format helpful?

We invite your comments and suggestions. Thank you.

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Name______________________________

Organization__________________________

Address_____________________________

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